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Professional interventions for general practitioners on the management of musculoskeletal conditions (Review)

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[Intervention Review]

Professional interventions for general practitioners on the management of musculoskeletal conditions

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ABSTRACT

Background

Musculoskeletal conditions require particular management skills. Identification of interventions which are effective in equipping general practitioners (GPs) with such necessary skills could translate to improved health outcomes for patients and reduced healthcare and societal costs.

Objectives

To determine the effectiveness of professional interventions for GPs that aim to improve the management of musculoskeletal conditions in primary care.

Search methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL), 2010, Issue 2; MEDLINE, Ovid (1950 - October 2013); EMBASE, Ovid (1980 - Ocotber 2013); CINAHL, EbscoHost (1980 - November 2013), and the EPOC Specialised Register. We conducted cited reference searches using ISI Web of Knowledge and Google Scholar; and handsearched selected issues of *Arthritis and Rheumatism* and *Primary Care-Clinics in Office Practice*. The latest search was conducted in November 2013.

Selection criteria

We included randomised controlled trials (RCTs), non-randomised controlled trials (NRCTs), controlled before-and-after studies (CBAs) and interrupted time series (ITS) studies of professional interventions for GPs, taking place in a community setting, aiming to improve the management (including diagnosis and treatment) of musculoskeletal conditions and reporting any objective measure of GP behaviour, patient or economic outcomes. We considered professional interventions of any length, duration, intensity and complexity compared with active or inactive controls.

Data collection and analysis

Two review authors independently abstracted all data. We calculated the risk difference (RD) and risk ratio (RR) of compliance with desired practice for dichotomous outcomes, and the mean difference (MD) and standardised mean difference (SMD) for continuous outcomes. We investigated whether the direction of the targeted behavioural change affects the effectiveness of interventions.

Main results

Thirty studies met our inclusion criteria.

From 11 studies on osteoporosis, meta-analysis of five studies (high-certainty evidence) showed that a combination of a GP alerting system on a patient's increased risk of osteoporosis and a patient-directed intervention (including patient education and a reminder to see their GP) improves GP behaviour with regard to diagnostic bone mineral density (BMD) testing and osteoporosis medication prescribing (RR 4.44; (95% confidence interval (CI) 3.54 to 5.55; 3 studies; 3,386 participants)) for BMD and RR 1.71 (95% CI 1.50 to 1.94; 5 studies; 4,223 participants) for osteoporosis medication. Meta-analysis of two studies showed that GP alerting on its own also probably improves osteoporosis guideline-consistent GP behaviour (RR 4.75 (95% CI 3.62 to 6.24; 3,047 participants)) for BMD and RR 1.52 (95% CI 1.26 to 1.84; 3.047 participants) for osteoporosis medication) and that adding the patient-directed component probably does not lead to a greater effect (RR 0.94 (95% CI 0.81 to 1.09; 2,995 participants)) for BMD and RR 0.93 (95% CI 0.79 to 1.10; 2,995 participants) for osteoporosis medication.

Of the 10 studies on low back pain, seven showed that guideline dissemination and educational opportunities for GPs may lead to little or no improvement with regard to guideline-consistent GP behaviour. Two studies showed that the combination of guidelines and GP feedback on the total number of investigations requested may have an effect on GP behaviour and result in a slight reduction in the number of tests, while one of these studies showed that the combination of guidelines and GP reminders attached to radiology reports may result in a small but sustained reduction in the number of investigation requests.

Of the four studies on osteoarthritis, one study showed that using educationally influential physicians may result in improvement in guideline-consistent GP behaviour. Another study showed slight improvements in patient outcomes (pain control) after training GPs on pain management.

Of three studies on shoulder pain, one study reported that there may be little or no improvement in patient outcomes (functional capacity) after GP education on shoulder pain and injection training.

Of two studies on other musculoskeletal conditions, one study on pain management showed that there may be worse patient outcomes (pain control) after GP training on the use of validated assessment scales.

The 12 remaining studies across all musculoskeletal conditions showed little or no improvement in GP behaviour and patient outcomes.

The direction of the targeted behaviour (i.e. increasing or decreasing a behaviour) does not seem to affect the effectiveness of an intervention. The majority of the studies did not investigate the potential adverse effects of the interventions and only three studies included a cost-effectiveness analysis.

Overall, there were important methodological limitations in the body of evidence, with just a third of the studies reporting adequate allocation concealment and blinded outcome assessments. While our confidence in the pooled effect estimate of interventions for improving diagnostic testing and medication prescribing in osteoporosis is high, our confidence in the reported effect estimates in the remaining studies is low.

Authors' conclusions

There is good-quality evidence that a GP alerting system with or without patient-directed education on osteoporosis improves guideline-consistent GP behaviour, resulting in better diagnosis and treatment rates.

Interventions such as GP reminder messages and GP feedback on performance combined with guideline dissemination may lead to small improvements in guideline-consistent GP behaviour with regard to low back pain, while GP education on osteoarthritis pain and the use of educationally influential physicians may lead to slight improvement in patient outcomes and guideline-consistent behaviour respectively. However, further studies are needed to ascertain the effectiveness of such interventions in improving GP behaviour and patient outcomes.

PLAIN LANGUAGE SUMMARY

Professional interventions for general practitioners (GPs) on the management of musculoskeletal conditions

Thirty studies met our inclusion criteria.

Eleven studies evaluated interventions aiming to improve the management of osteoporosis by GPs. Five of these studies were sufficiently similar that we were able to combine their results. Our findings suggest that alerting the GP that a patient is at risk of osteoporosis and educating the patient, reminding them to visit their GP, leads to improved GP behaviour (diagnostic testing and medication prescribing). We determined that the quality or certainty of the evidence from these studies is high, so we are confident in these results. GP alerting on its own is also probably effective according to two studies and adding the patient-directed component probably does not lead to a greater effect.

Of the ten studies on low back pain, seven showed that GP education and distribution of guidelines may lead to little or no improvement with regards to GPs' clinical behaviour. Two studies showed that providing GPs with guidelines and information on the total number of tests they request may have an effect on GP behaviour (resulting in a slight reduction in the number of tests). One study showed that using a combination of guidelines and GP reminders attached to test reports may result in a small but sustained reduction in the number of tests.

Of the four studies on osteoarthritis, one found that GP behaviour may improve when prominent GPs are recruited to educate their colleagues. A second study showed slight improvements in patient outcomes (pain control) after training GPs on pain management.

Of the three studies on shoulder pain, one study showed that there may be little or no improvement in patient outcomes (functional capacity) after GP education on shoulder pain and injection training.

Of the two studies on other musculoskeletal conditions, one study on pain management showed worse patient outcomes (pain control) after GP training on the use of tools to measure pain.

The 12 remaining studies across all musculoskeletal conditions showed little or no improvement in GP behaviour and patient outcomes. The majority of the studies did not investigate the potential adverse effects of the interventions and only three studies included a cost-effectiveness analysis.

The direction of the targeted behaviour (i.e. increasing or decreasing a behaviour) does not seem to affect the effectiveness of an intervention.

The certainty of the evidence was high from studies that examined the effectiveness of interventions to improve the management of osteoporosis by GPs, so we are confident in these findings. There were important limitations in how most of the remaining studies were conducted or reported, and we are less certain of the likely effects of these interventions to improve the management of musculoskeletal conditions.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON [Explanation]

Primary care physician alerting system and a patient-directed intervention (education and reminder to see their primary care physician) compared to usual care for osteoporosis management

Patient or population: General practitioners/family doctors involved in the management of patients with osteoporosis
Settings: Primary care
Intervention: Primary care physician alerting system and a patient-directed intervention (education and reminder to see their primary care physician)
Comparison: Usual care

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Certainty of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Usual care	A physician alerting system and a patient-directed intervention (education and reminder to see their primary care physician)				
Bone Mineral Density [1] Follow-up: 6-12 months	Study population		RR 4.44 (3.54 to 5.55)	3386 (3 studies)	⊕⊕⊕⊕ high[3]	
	49 per 1000	220 per 1000 (124 to 390)				
	Moderate					
	39 per 1000	176 per 1000 (99 to 311)				
Osteoporosis medication [2] Follow-up: 6-12 months	Study population		RR 1.71 (1.50 to 1.94)	4223 (5 studies)	⊕⊕⊕⊕ high[3]	
	131 per 1000	241 per 1000 [3] (193 to 301)				
	Moderate					

	106 per 1000	**195 per 1000** [3] (156 to 244)	

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence interval; **RR:** Risk ratio;

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] Bone mineral density (BMD) testing is an important outcome for osteoporosis because it leads to the diagnosis of the condition. This is one of the GP behaviour-related outcomes (primary outcome)

[2] Osteoporosis medication prescribing is an important outcome for osteoporosis management as it is the main aspect of treatment. This is one of the GP behaviour-related outcomes (primary outcome)

[3] One of the five studies (Roux 2013) had two intervention comparison groups which were combined to create a single pair-wise comparison as recommended in chapter 16.5.4 of the Cochrane Handbook.

BACKGROUND

One in six adults (15.6%) suffers from a longstanding condition of the musculoskeletal system (Arthritis Research UK 2011). Between 12 and 20% of general practitioner (GP) consultations are for musculoskeletal problems (Jordan 2007; McCormick 1995; RCGP 1995). Musculoskeletal impairments ranked number one in chronic impairments in the USA (National Center for Health Statistics 1995). Work-related musculoskeletal disorders were responsible for 11 million days lost from work in 1995 in the United Kingdom (UK) and tended to involve higher percentages of long-term work loss in the USA when compared with all non-fatal injuries and illnesses in 2001 (Jones 1998; Worker Health Chartbook 2004). In the Ontario Health Survey musculoskeletal conditions caused 40% of all chronic conditions, 54% of all long-term disability, and 24% of all restricted activity days (Badley 1994). However, musculoskeletal training has not been part of traditional GP training and has only recently been introduced as part of the new Royal College of General Practitioners curriculum (RCGP Curriculum 2006).

The World Health Organization (WHO) dedicated the years 2000 to 2010 as Bone and Joint Decade. The importance of improving competency in the management of musculoskeletal problems within primary care settings is highlighted by Akesson et al in the Bulletin of the WHO (WHO 2003). Many GPs/family doctors do not have adequate training and consequently lack the competency, skills and confidence to manage musculoskeletal disorders in their daily practice; they may not recognise conditions or be aware of what can be achieved by appropriate care (WHO 2003).

The majority of research on educational interventions for healthcare professionals focuses mainly on improving theoretical knowledge and clinical decision making, with less emphasis on skill acquisition. However, competency in examination and technical skills, such as joint injections, is of paramount importance for appropriate diagnosis and management of musculoskeletal conditions. Technical skills require the use of targeted approaches for effective teaching, learning, and assessment (Ajit 2004). Interventions that may be successful at improving practice in other areas of medicine may therefore not achieve the same results in musculoskeletal medicine.

It is generally accepted that systematic development is needed for quality-improvement interventions to be effective. Tailoring their content and format to the specific features of a target group and setting seems necessary to improve their effectiveness (Van Bokhoven 2003). Characteristics of the individual provider are important. For example, a programme to increase specific knowledge is likely to have a greater effect on providers with lower baseline knowledge, but paradoxically practitioners are more likely to place greater emphasis on topics of continuing education in which they have traditionally received the greatest amount of training (Forrest 1989). Efforts to tailor interventions to particular provider needs warrant greater attention (Kroenke 2000). Competing demands inherent in the primary care setting (such as limited time, frequent medical comorbidity and somatisation) need to be considered. Failure to recognise these constraints may sabotage interventions (Klinkman 1997). It cannot be assumed that interventions which are effective in changing behaviour and improving management by hospital specialists will also be effective in improving care provided by GPs or family doctors.

The identification of successful professional interventions to improve the management of musculoskeletal conditions by GPs could potentially result in improved health outcomes for patients, reduced healthcare costs and also reduced social costs related to the loss of productivity and earnings. The aim of this systematic review is to identify those professional interventions that improve management, and to quantify their effects.

OBJECTIVES

To determine the effectiveness of professional interventions for general practitioners/family doctors that aim to improve the management of musculoskeletal conditions in primary care.

METHODS

Criteria for considering studies for this review

Types of studies

We considered randomised controlled trials (RCTs), non-randomised controlled trials (NRCTs), controlled before-and-after studies (CBAs) and interrupted time series (ITS) studies for this review, in accord with the protocol (Tzortziou 2008). We used the eligibility criteria for NRCTs published by the Effective Practice and Organisation of Care (EPOC) Group (EPOC 2013a). According to this guidance, we excluded studies with only one intervention or control site. We included CBA studies with at least two intervention sites and two control sites. We excluded ITS studies that did not have a clearly-defined point in time when the intervention occurred and at least three data points before and three after the intervention.

Types of participants

We included studies evaluating interventions within a primary care setting, targeting the following types of participants:

- Individual general practitioners (GPs)/family doctors
- Groups of GPs/family doctors
- Multidisciplinary care teams (i.e. groups of healthcare workers of different disciplines) where GPs/family doctors are a substantial part of the team (50% or more)

Types of interventions

Any professional interventions aimed at GPs/family doctors, designed to improve the management of musculoskeletal conditions in the community. Such conditions include neck pain, back pain and other regional pain, possible or known arthritis (including osteoarthritis, rheumatoid arthritis and spondylo-arthropathies), osteoporosis, musculoskeletal injuries and trauma. We used the term 'management' in its broader definition within general practice, which includes diagnosis, investigations, explanation, advice, prescribing, medical interventions/procedures, referral and prevention.

We considered professional interventions of any length, duration, intensity and complexity compared with active (i.e. different interventions) or inactive (e.g. standard care) controls.

Eligible professional interventions include the following and their combinations (based on the EPOC taxonomy, EPOC 2002):

- Distribution of educational materials including clinical guidelines
- Educational meetings
- Educational outreach visits
- Patient-mediated interventions
- Audit and feedback
- Computer-aided decision support
- Marketing-focus groups
- E-learning/web-based educational programmes
- Educational courses with formal examination/assessment (rather than attendance certificate only)
- Mentoring
- Training workshops
- Local consensus processes
- Local opinion leaders
- GP reminder

Types of outcome measures

Primary outcomes

Any objective measure (using validated tools wherever available) of health professional behaviour related outcomes, patient or economic outcomes such as:

a) Health professional (GP) behaviour-related outcomes

These outcomes measure GP behaviour, care provision and adherence to recommended practice or guidelines across all aspects of musculoskeletal management. As mentioned above, the term 'management' is used in its broader definition within general practice, which includes diagnosis, investigations, explanation, advice, prescribing, medical interventions/procedures, referral and prevention. Examples of such outcomes include the following:

- Rates of diagnosis and diagnostic accuracy
- Rates of appropriate clinical assessment/examination
- Use of relevant clinical assessment and shared decision support tools (e.g. pain assessment score tools)
- Ordering of tests/investigations to confirm a diagnosis or exclude other conditions (e.g. x-rays, MRIs, bone scans, ultrasound scans, bone mineral density (BMD) scans, blood tests)
- Prescribing of medication (e.g. non-steroidal anti-inflammatory medications for symptomatic pain relief, osteoporosis medication for treatment)
- Provision of medical interventions/procedures (e.g. minor surgery, joint injections, ultrasound treatment)
- Referral rates to other services (e.g. physiotherapy, occupational therapy, secondary-care specialist clinics)

b) Patient outcomes

- Symptom burden and health status
    - Markers of disease control (e.g. pain scores)
    - Symptom days/scores
    - Functional health status (e.g. disability scores)
    - Quality of life, morbidity, mortality
    - School/work days lost
- Patient behaviour and utilisation of health care
    - Medication adherence
    - Consultation length
    - Patient repeat visits with same musculoskeletal complaint
    - Emergency Department visits
    - Patient sickness certification
    - Hospitalisations

c) Economic outcomes

- Health service and societal costs
- Cost effectiveness (for example, incremental cost-effectiveness ratios (ICERs), incremental cost per quality-adjusted life year (QALY) and cost-benefit ratios)
- Cost utility

Secondary outcomes

- Patient knowledge or satisfaction
- GP knowledge, attitude or satisfaction on the management of musculoskeletal conditions

We included measures of GPs' and patients' knowledge, attitudes or satisfaction in this review, as these may provide useful secondary information. However, we excluded studies only reporting knowledge, attitudes or satisfaction (i.e. secondary outcomes) with no objective measure of professional performance, patient health or economic outcomes (i.e. primary outcomes).

Search methods for identification of studies

We searched the Cochrane Database of Systematic Reviews and the Database of Abstracts of Reviews of Effects (DARE) for related systematic reviews, and the electronic databases listed below for primary studies. We designed a sensitive search strategy to retrieve studies from these databases. We applied neither language nor date restrictions. We conducted searches in August 2010 and November 2013; we include the exact search dates for each database with the search strategies in Appendix 1

- Cochrane Central Register of Controlled Trials (CENTRAL), via EBM Reviews OvidSP (2013)
- Cochrane Methodology Register, Health Technology Assessment, NHS Economic Evaluation Database, via EBM Reviews OvidSP (2013)
- MEDLINE via OVID (1946 - October 2013)
- EMBASE via OVID (1947 - October 2013)
- CINAHL via EbscoHost (1980 - November 2013)

We used the Cochrane 2013 sensitivity and precision-maximising filter for retrieving RCTs from MEDLINE (Lefebvre 2011). To retrieve NRCT, CBA and ITS studies, we applied the EPOC Methods Filter 2.6 (developed by the EPOC Trials Search Co-ordinator (TSC), January 2013 version). The search strategy was devised for the OVID Medline interface and then adapted for the other databases. For other databases, where no filter exists, study designs can only be identified at the screening stage (see Types of studies).

Searching other resources

We also:

1. screened individual journals, e.g. handsearched: *Arthritis and Rheumatism* (ISSN 1529-0131) (November 1995 - August 2012), and *Primary Care-Clinics in Office Practice* (ISSN 0095-4543) (March 1996 - June 2012);
2. reviewed reference lists of all included studies, relevant systematic reviews, and primary studies;
3. conducted cited reference searches using ISI Web of Knowledge and Google Scholar for all studies selected for inclusion in this review.

Data collection and analysis

Selection of studies

Two review authors (VTB and NM) independently assessed all titles and abstracts of articles identified by the searches. We obtained the full-text articles of studies meeting the initial inclusion criteria and for which we could not determine eligibility. Both authors independently read the full text to confirm studies as acceptable or not. A third review author (DM) was available to resolve any disagreements. We list those that initially appeared to meet the inclusion criteria but that we later deemed unsuitable for inclusion, in the Characteristics of excluded studies tables, together with reasons for their exclusion. We documented the number of articles screened, assessed for eligibility, and selected for inclusion in a PRISMA flow diagram.

Data extraction and management

Two review authors (VTB and NM) independently extracted details of study design, population, intervention and control, and outcome data from included articles using a data extraction form based on the EPOC data abstraction form (see EPOC 2013b). For economic outcomes, we designed data extraction forms according to the *Cochrane Handbook for Systematic Reviews of Interventions* (*Cochrane Handbook*: Shemilt 2011). We piloted the data extraction form on two included studies to minimise misinterpretation, resolving any disagreement between the review authors regarding study suitability or data extraction by discussion and consensus. If necessary, we consulted a third review author (DM, MU or OW) to resolve disagreements.

Assessment of risk of bias in included studies

We assessed the risk of bias of the included studies in accordance with EPOC and Cochrane guidance (EPOC 2015; Higgins 2011b). We used the Cochrane tool for assessing risk of bias for the included RCTs.The seven domains we addressed were: sequence generation, allocation concealment, blinding of participants, blinding of outcome assessment, incomplete outcome data, selective outcome reporting and "other bias". The seventh domain, "other bias", included a baseline assessment (on whether the groups differed in fundamental ways in terms of baseline characteristics and outcomes) and an assessment of whether there was any protection against contamination. By answering a prespecified question about the adequacy of the study in relation to each of the above domains, we made a judgement indicating low, high or unknown risk of bias. Two review authors (VTB and NM) independently assessed the overall risk of bias for each domain within each study. Review authors were not blinded to study author, institution, or journal, as evidence indicates that little benefit is achieved through blinding (Berlin 1997). We assessed the risk of bias for NRCTs using the suggested risk of bias criteria for EPOC reviews (EPOC 2015). We resolved any disagreement between review authors (VTB and NM) by discussion and consensus.

Measures of treatment effect

We reported outcomes for each study in natural units. Where baseline results were available from RCTs, NRCTs and CBAs, we reported pre-intervention and post-intervention means or proportions for both study and control groups.

For studies reporting dichotomous outcomes, we reported the absolute difference (risk difference, RD) calculated as the post-intervention proportion of outcome in intervention group minus the post-intervention proportion in the control group. We defined the effect size as 'small' if RD was less than or equal to 5%, 'modest' if greater than 5% but less than or equal to 10%, 'moderate' if greater than 10% but less than or equal to 20%, and 'large' if greater than 20%, according to Grimshaw 2004. We reported the relative percentage difference (absolute difference divided by post-intervention score in the control group). When baseline levels were available, we calculated the absolute adjusted risk difference (ARD), which adjusts for baseline differences between groups as used by Flodgren 2011 and French 2010. An adjusted risk difference (ARD) is the difference between intervention and control group proportions of compliance after (post) the intervention minus the difference between groups before (pre) the intervention which may be expressed as: Adjusted risk difference (ARD) = (risk of compliance (intervention − control) post-intervention) − (risk of compliance (intervention − control) pre-intervention). We also calculated the risk ratio (RR) for all outcomes and included the P values as reported by the study authors. When summarising the results of a study in a summary table, for studies reporting more than one dichotomous outcome in which none was identified as a primary outcome, we reported the effect sizes for all outcomes.

For studies reporting continuous data, we calculated the absolute mean difference between intervention and control groups (MD) and the relative percentage change i.e. the per cent improvement relative to the post-intervention mean in the control group. We calculated standardised mean differences (SMD) by dividing the difference in mean scores between the intervention and comparison group in each study, by an estimate of the pooled standard deviation according to Smith 2016. We considered the SMD to be small if < 0.40, moderate if 0.40 to 0.70 and large if > 0.70 according to Chapter 12.6.of the *Cochrane Handbook* (Schünemann 2011). Wherever possible, we also calculated the relative percentage change adjusted for baseline differences in the outcome measures (i.e. the absolute post-intervention difference between the intervention and control groups minus the absolute pre-intervention difference between the intervention and control groups, divided by the post-intervention mean in the control group) according to *Analysis in EPOC reviews* (EPOC 2013e).

The direction of effect differed between studies, with some studies expecting an increase in outcome (such as an increase in BMD testing for osteoporosis) and others expecting a decrease (such as reduction of x-ray requests for low back pain) according to the guidelines. In all cases we standardised the effect size, so that a positive RD, ARD, MD or SMD represents a beneficial intervention outcome compared to control, according to Grimshaw 2004.

For the ITS study, we reported the pre- and post-intervention means, their difference, the relative percentage change and the mean change in level and slope.

We used 'Summary of findings' tables for the main comparisons in the review, to interpret the results and draw conclusions about the effects of different interventions, including the size of effects and certainty of the evidence.

Unit of analysis issues

For clustered randomised studies with potential unit of analysis errors, we attempted to re-calculate the effect sizes using intracluster (or intraclass) correlation coefficient (ICC) wherever possible, according to Chapter 16.3 of the *Cochrane Handbook* (Higgins 2011a). Where the relevant data was not available to allow the re-calculation of effect sizes incorporating the effect of clustering, we reported the relevant effect sizes without the confidence intervals and P values and highlighted the potential unit of analysis errors (French 2010, Ukoumunne 1999).

Assessment of heterogeneity

Given the wide scope of the review, we anticipated that many of the included studies would be too heterogeneous in terms of intervention types, musculoskeletal conditions targeted and outcomes measured to undertake meta-analysis.

We assessed heterogeneity using the Chi^2 and I^2 tests, as described by Higgins 2003 and the *Cochrane Handbook* (Deeks 2011). We pooled results when a minimum of two studies were homogeneous regarding the participants, interventions and outcomes.

Where pooling was not possible, we presented a narrative summary and attempted to organise the studies into groupings or clusters (by musculoskeletal condition, intervention type, and study design) so that it is easier to identify patterns in results, both within and between the groups that were formed. We presented the studies in tabular form, reporting the results descriptively, and made a qualitative assessment of their effects.

Data synthesis

We pooled the results of studies which were homogeneous regarding the interventions and outcomes as mentioned above, and used a fixed-effect meta-analysis (Mantel-Haenszel method) to report risk ratios (RRs) for dichotomous data, in accordance with the *Cochrane Handbook* (Deeks 2011). We used risk ratios because reporting relative effect measures is, on average, more consistent than absolute measures, and this is in accordance with the *Cochrane Handbook* (Deeks 2011).

If corrected data, taking into account the unit of analysis errors, were reported for cluster-randomised trials, we planned to use these data for meta-analysis. If corrected data were not reported, we intended to estimate corrections if adequate data were available; however, these data were also not reported and were not available after contacting the authors.

We assessed the overall confidence in estimate of effect (certainty of evidence) for each outcome using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) approach which classifies the certainty or confidence of the evidence

as high, moderate, low or very low in consideration of five factors: risk of bias or study limitations, directness, consistency of results, precision and publication bias (Guyatt 2008).

Two review authors independently assessed the certainty of evidence; resolving disagreements by discussion. We did not exclude studies on the basis of GRADE ratings; we took into account the certainty of evidence when interpreting the results. For assessments of the overall certainty of evidence for each outcome that included pooled data from RCTs only, we downgraded the evidence from 'high certainty' by one level for serious (or by two for very serious) study limitations (risk of bias), indirectness of evidence, serious inconsistency, imprecision of effect estimates or potential publication bias. Data from observational studies started at 'low certainty'.

Subgroup analysis and investigation of heterogeneity

We summarised the results meaningfully and organised the studies into groupings or clusters to identify patterns in results. Clinically, the main source of heterogeneity amongst studies is the musculoskeletal condition studied, as this can often determine the type of intervention and measured outcomes. For example, certain outcomes (such as BMD scanning or steroid injections) are only applicable in specific musculoskeletal conditions. We therefore reported the results of the included studies grouped by condition, i.e. osteoporosis, osteoarthritis, low back pain, shoulder pain and other musculoskeletal conditions. In each condition group, we divided the evaluations of interventions against 'no intervention' control groups and against a 'different intervention' control group. French 2010 followed the same approach in their review.

The vast majority of the included studies (26/30) focused on single musculoskeletal conditions. Therefore, by grouping the studies by condition, we were able to establish whether within-study relationships were replicated across similar studies. This boosted our confidence in the findings, as differences in subgroups that are observed within studies are more reliable than analyses of subsets of studies (EPOC 2013c).

The osteoporosis studies which were sufficiently similar for their results to be combined were further divided into those where the intervention targeted just GPs versus those where both GPs and patients were targeted. This allowed an assessment of the effect of adding a patient directed component to interventions targeting a GP in order to establish whether the combined intervention results in improved outcomes.

We also did a subgroup analysis to assess the intended direction of the intervention's effect on the targeted behavioural change (i.e. whether increasing or decreasing an existing behaviour resulted in different effects). These additional aspects of analysis were not part of the protocol and were added post hoc in order to further explore heterogeneity.

Sensitivity analysis

We conducted a sensitivity analysis in order to ensure that the findings of any meta-analysis are not dependent on arbitrary or unclear methodological decisions, in accordance with the *Cochrane Handbook* (Deeks 2011). The sensitivity analysis was to reconsider our analysis methods. In our meta-analysis we planned to use risk ratios as recommended in the *Cochrane Handbook* (Deeks 2011). However, it is often sensible to re-express the results using a more easily interpretable statistic such as the risk differences (Higgins 2011a). We therefore decided to re-analyse the results using risk difference in order to investigate whether the choice of summary statistic could influence the conclusions of the meta-analysis.

RESULTS

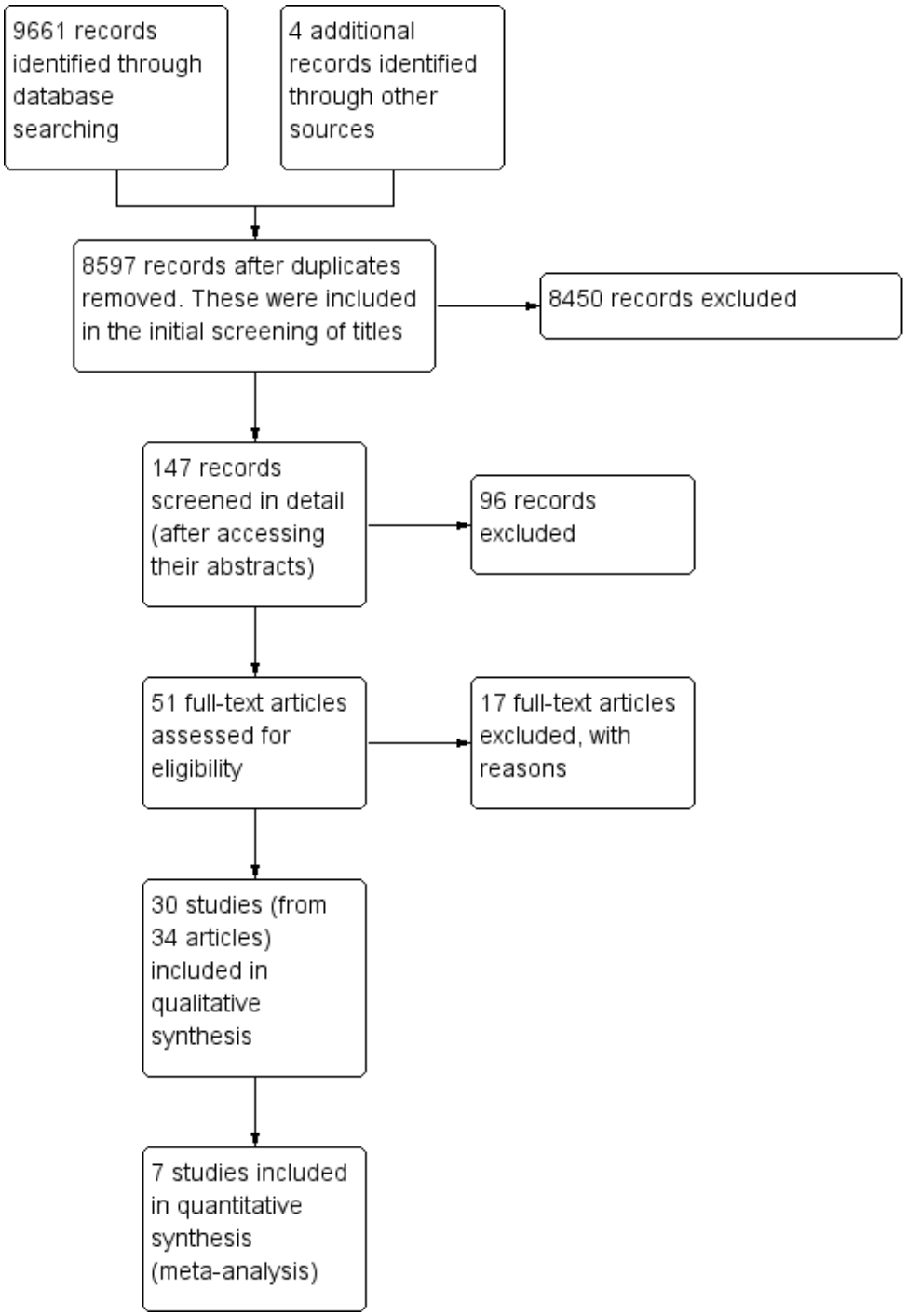
Description of studies

See Characteristics of included studies, Characteristics of excluded studies

Results of the search

Figure 1 outlines the process from searching to study inclusion. We retrieved 9,665 potentially applicable citations from searches of electronic databases (CENTRAL, MEDLINE, EMBASE, CINAHL, and the EPOC Register) and handsearches of other resources.

Figure 1. Prisma study flow diagram.



Two review authors (VTB and NM) independently screened the titles and abstracts of the studies and excluded 9614 records, leaving 51 studies eligible for full-text review. Thirty of these studies met our inclusion criteria and we describe their characteristics in the Characteristics of included studies table. Studies initially appearing appropriate for inclusion, but then subsequently excluded have their primary reason for exclusion listed in the Characteristics of excluded studies table.

Included studies

Characteristics of study design and setting:

Seventeen included studies were cluster-randomised trials, eleven were individual randomised trials, one (Broadhurst 2007) was a CBA and one (Hollingworth 2002) was an interrupted time series. There were no NRCTs. Seventeen of the studies were two-arm trials, eight compared three arms and five compared four arms.

All of the included studies were conducted in high-income countries, with eight based in Canada, eight in the USA, six in the UK, two in Germany, two in France, two in Australia, one in the Netherlands and one in Northern Ireland. All of the studies evaluated professional interventions for GPs. We found no studies targeting multidisciplinary care teams where GPs constituted 50% or more of the participants.

All of the studies evaluated interventions delivered in a primary care setting.

Characteristics of the professional interventions:

Eleven studies focused on the management of osteoporosis, ten on low back pain of which two included knee pain, four on the management of osteoarthritis, three on shoulder pain and the remaining two on other musculoskeletal pain.

Out of the thirty studies, twenty-four included interventions addressed solely to the GP (Becker 2008; Bishop 2006; Boyd 2002; Broadhurst 2007; Chassany 2006; Dey 2004; Eccles 2001; Engers 2005; Feldstein 2006; French 2013; Gormley 2003; Hazard 1997; Hollingworth 2002; Huas 2006; Kerry 2000; Leslie 2012; Rahme 2005; Robling 2002; Rosemann 2007; Rozental 2008; Schectman 2003; Solomon 2007a; Stross 1985; Watson 2008). Ten studies (Bessette 2011; Bishop 2006; Ciaschini 2010; Cranney 2008; Feldstein 2006; Lafata 2007; Leslie 2012; Majumdar 2008; Roux 2013; Solomon 2007a) combined professional interventions with patient-directed interventions such as patient-directed education and reminders to see their GP. These patient-directed components have been described as such whenever encountered.

Table 1 presents the classification of different educational interventions according to EPOC taxonomy (EPOC 2002). The thirty included studies provided an evaluation of a wide range of different professional interventions. Table 2 provides a summary of these.

Studies comparing an intervention to a 'no intervention' control:

Twenty-three of the included studies assessed an intervention against a 'no intervention' or 'usual care' control (Bessette 2011; Bishop 2006; Broadhurst 2007; Chassany 2006; Ciaschini 2010; Cranney 2008; Dey 2004; Engers 2005; Feldstein 2006; French 2013; Hazard 1997; Huas 2006; Kerry 2000; Lafata 2007; Leslie 2012; Majumdar 2008; Rahme 2005; Rosemann 2007; Roux 2013; Schectman 2003; Solomon 2007a; Stross 1985; Watson 2008) and Table 3 shows the different components of these interventions. Distribution of educational material in combination with an educational meeting/workshop was the most frequent intervention assessed against a no-intervention control, and was evaluated in six studies. Distribution of educational materials was the intervention most frequently used as a component of a multifaceted intervention.

Studies comparing an intervention to a different intervention:

Fifteen studies (Becker 2008; Bessette 2011; Bishop 2006; Boyd 2002; Eccles 2001; Feldstein 2006; Gormley 2003; Lafata 2007; Leslie 2012; Rahme 2005; Robling 2002; Rosemann 2007; Roux 2013; Rozental 2008; Solomon 2007a) evaluated single or multifaceted interventions against another intervention. The majority of the studies evaluated different intervention combinations (see Table 4).

Excluded studies

The main reasons for the studies' exclusion were methodological limitations; for example, absence of two control and two intervention groups in CBAs, or observational studies with no comparison groups (Fabiani 2004; Feldstein 2007; Garala 1999; Gardner 2002; Ioannidis 2008; Ioannidis 2009; McDonald 2003; Nazareth 2002). We excluded five studies because fewer than 50% of the participants were GPs (Gardner 2005; Glazier 2005; Goldberg 2001; Solomon 2007b; Vernacchio 2013). We excluded two studies because they did not evaluate professional interventions on the management of musculoskeletal conditions (Corson 2011; Rolfe 2001), and a further two because they did not report on objectively-measured primary outcomes (Ashe 2004; Ruiz 2001). The exact reasons for exclusion for each study are detailed in the Characteristics of excluded studies table.

Risk of bias in included studies

We present the findings of 'Risk of bias' assessments in Figure 2 and Figure 3 to demonstrate a graphical representation of the judgements about each of the risk of bias items, and in Figure 4 and Figure 5 to present these as percentages across all included studies.

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

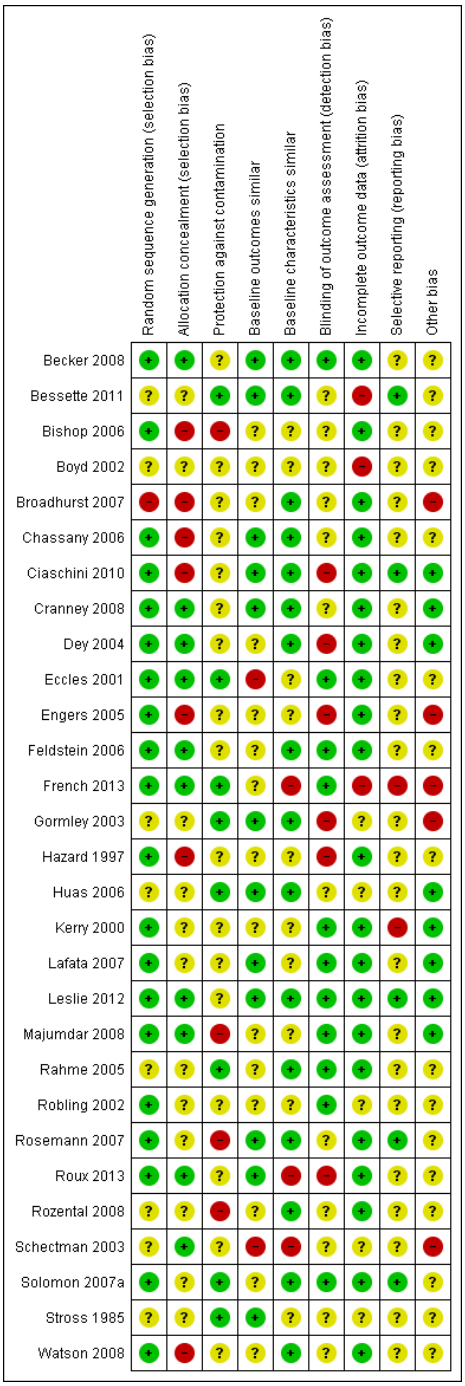


Figure 3. Risk of bias summary for ITS study design: review authors' judgements about each risk of bias item for each included study.

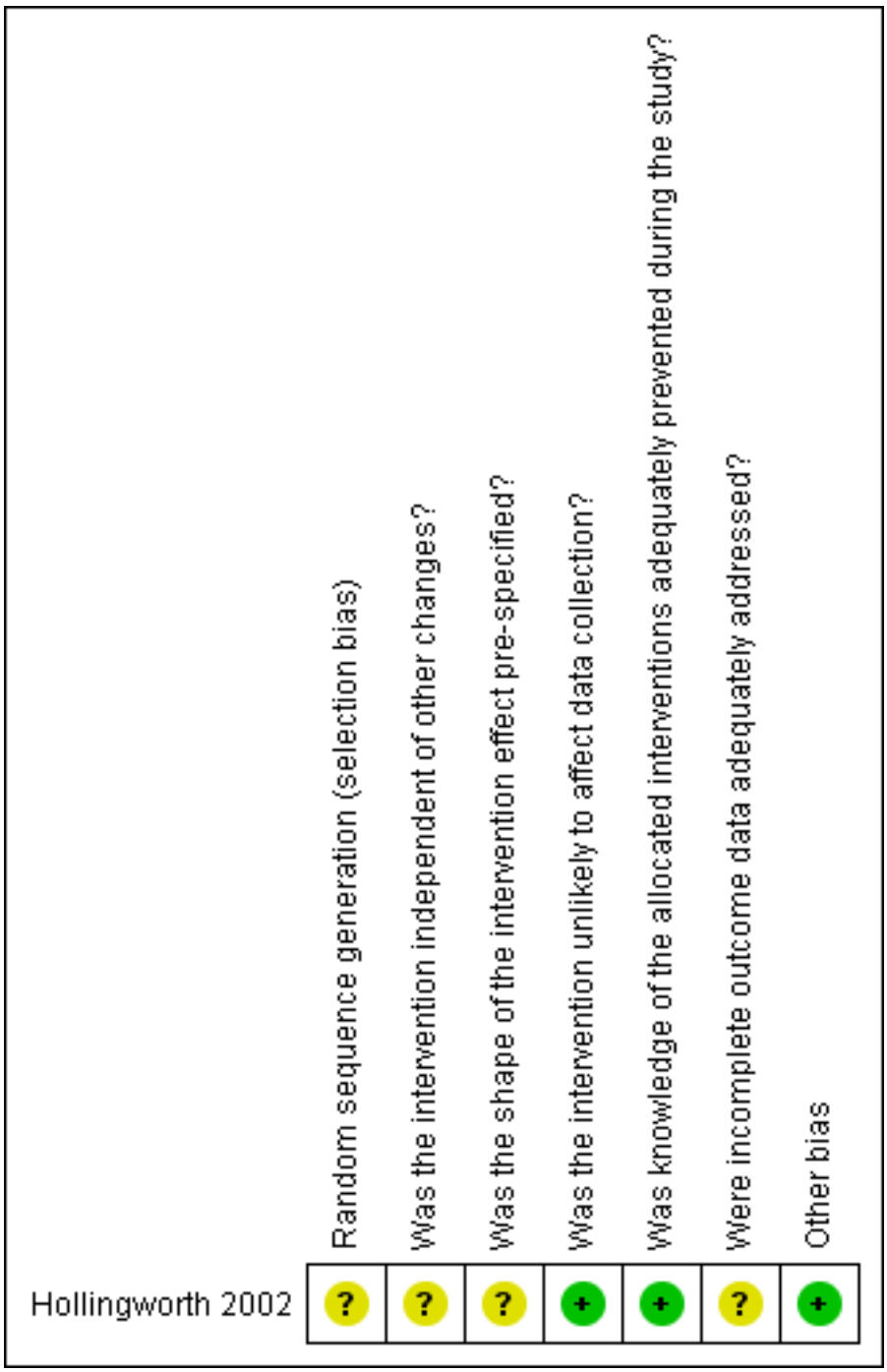


Figure 4. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

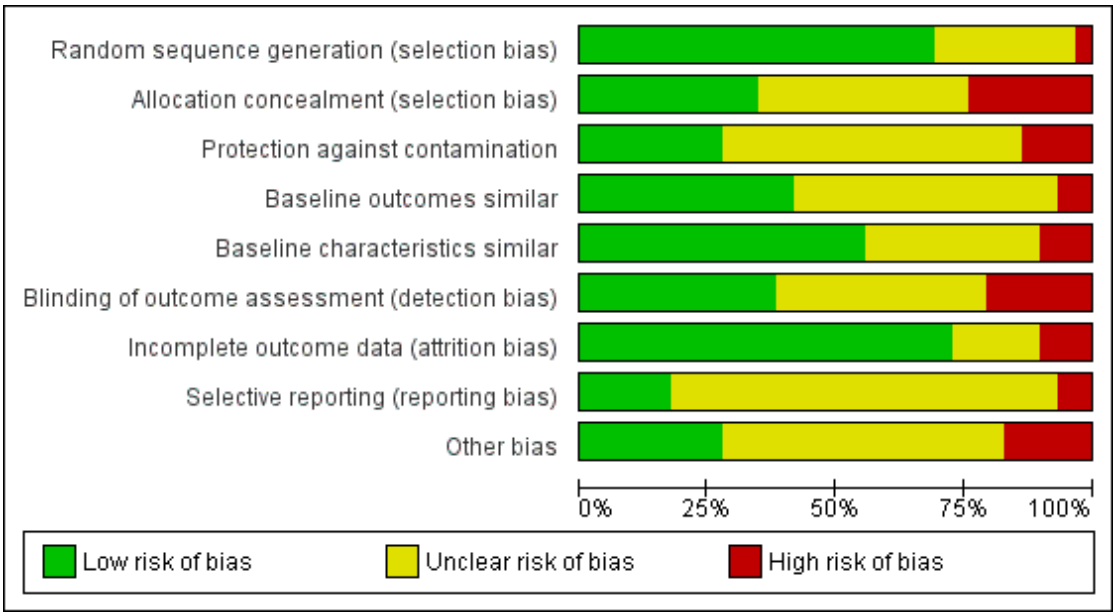
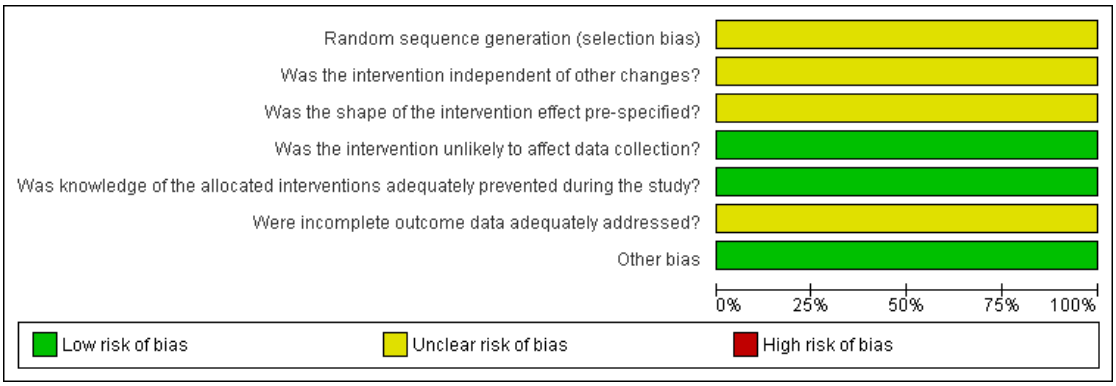


Figure 5. Risk of bias graph for ITS study design: review authors' judgements about each risk of bias item presented as percentages across all included studies.



Overall, with the exception of the five studies included in the meta-analysis, there was a high risk of bias across the included studies. Despite the fact that twenty-eight out of the thirty studies were randomised trials, in eight studies (Bessette 2011; Boyd 2002; Gormley 2003; Huas 2006; Rahme 2005; Rozental 2008; Schectman 2003; Stross 1985) the method for random sequence generation was unclear.

With regard to the study by Hollingworth 2002, which used an ITS design, it was unclear whether the intervention took place independently of other changes and there was insufficient information on the shape of the intervention effect and the completeness of the outcome data.

Allocation

We judged seven out of the twenty-nine controlled trials to have a high risk of bias for allocation concealment, and twelve had an unclear risk as they did not contain enough information for the risk to be estimated.Ten studies had a low risk of selection bias (Becker 2008; Cranney 2008; Dey 2004; Eccles 2001; Feldstein 2006; French 2013; Leslie 2012; Majumdar 2008; Roux 2013; Schectman 2003).

Blinding

We rated six of the twenty-nine controlled trials as having a high risk of detection bias, twelve studies as having an unclear risk, and eleven studies with a low risk of such bias (Becker 2008; Eccles 2001; Feldstein 2006; French 2013; Kerry 2000; Lafata 2007; Leslie 2012; Majumdar 2008; Rahme 2005; Robling 2002; Solomon 2007a).

In half of the controlled studies, blinding of the participants was either unclear or did not happen (Bishop 2006; Boyd 2002; Feldstein 2006; French 2013; Hazard 1997; Lafata 2007; Rahme 2005; Robling 2002; Rosemann 2007; Roux 2013; Rozental 2008; Schectman 2003; Solomon 2007a; Stross 1985; Watson 2008).

Incomplete outcome data

Three controlled studies had a high risk of bias for incomplete outcome data (Bessette 2011; Boyd 2002; French 2013), five had an unclear risk (Gormley 2003; Huas 2006; Robling 2002; Schectman 2003; Stross 1985) and we judged the remaining twenty-one controlled studies to have a low risk of such bias.

Selective reporting

Two controlled studies (French 2013; Kerry 2000) had a high risk of selective reporting bias, twenty-two had an unclear risk, and we judged five to be at low risk (Bessette 2011; Ciaschini 2010; Leslie 2012; Rosemann 2007; Solomon 2007a).

Other potential sources of bias

Other areas assessed for sources of bias included protection against contamination (only eight out of the twenty-nine controlled studies were at low risk) and whether a baseline assessment of the intervention groups had taken place with regard to group characteristics (only eleven out of the twenty-nine controlled studies were at low risk) and baseline outcomes (we judged sixteen of twenty-nine controlled studies to be at low risk).

Effects of interventions

See: **Summary of findings for the main comparison** Primary care physician alerting system and a patient-directed intervention (education and reminder to see their primary care physician) compared to standard care for osteoporosis management; **Summary of findings 2** Primary care physician alerting system compared to usual care for osteoporosis management; **Summary of findings 3** Primary care physician alerting system compared to primary care physician alerting system and a patient-directed intervention (education and reminder to see their primary care physician) for osteoporosis management; **Summary of findings 4** Osteoporosis studies: Summary of findings; **Summary of findings 5** Low back pain studies: Summary of findings; **Summary of findings 6** Osteoarthritis studies: Summary of findings; **Summary of findings 7** Shoulder pain studies: Summary of findings; **Summary of findings 8** Studies on other musculoskeletal conditions: Summary of findings

We were only able to include five out of the thirty studies in a meta-analysis. These five studies evaluated interventions aiming to improve the management of osteoporosis (Ciaschini 2010; Feldstein 2006; Leslie 2012; Majumdar 2008; Roux 2013) and were sufficiently similar in terms of condition studied, intervention and outcomes (GP behaviour-related outcomes: osteoporosis diagnostic testing and medication prescribing), that we could pool the results.

In many studies there was no reporting of baseline performance and therefore for these studies we were unable to calculate an adjusted risk difference (ARD) for dichotomous measures and adjusted relative percentage change for continuous measures.

No study investigated the potential adverse effects of the interventions on professionals' health behaviours, coverage or access, quality of care or healthcare providers. Three studies on low back pain (Becker 2008; Dey 2004; Hazard 1997) reported on sickness certification/work absence (social outcome). One study (Rosemann 2007) reported on service utilisation. Three studies (Majumdar 2008; Robling 2002; Watson 2008) investigated the potential effects on resources and included a cost-effectiveness analysis.

We explored the possibility of grouping the studies by intervention type and pooling the results to assess their effect. However, this was not always clinically appropriate, because not all intervention outcomes were applicable to all musculoskeletal conditions (for example, bone mineral density (BMD) scanning was only applicable for osteoporosis).

We presented the included studies classified by condition (osteoporosis, osteoarthritis, low back pain, shoulder pain and other musculoskeletal conditions). For each condition, we divided the study results into two groups: evaluation of interventions against a no-intervention control and evaluation of interventions against 'other intervention' groups.

Osteoporosis studies:

Eleven studies included people with diagnosed osteoporosis or at risk of its development (Bessette 2011; Boyd 2002; Ciaschini 2010; Cranney 2008; Feldstein 2006; Lafata 2007; Leslie 2012; Majumdar 2008; Roux 2013; Rozental 2008; Solomon 2007a). Eight of these studies (Bessette 2011; Cranney 2008; Feldstein 2006; Leslie 2012; Majumdar 2008; Roux 2013; Rozental 2008;

Solomon 2007a) were for secondary prevention of osteoporosis, and focused on people with a previous fracture and at an increased risk of having osteoporosis. Six studies were conducted in Canada, and five were set in the USA. Six studies were individual RCTs (Bessette 2011; Ciaschini 2010; Feldstein 2006; Leslie 2012; Majumdar 2008; Roux 2013), three were cluster-RCTs (Cranney 2008; Lafata 2007; Solomon 2007a) and two were randomised trials without control groups (Boyd 2002; Rozental 2008). The desired management outcome in all of the studies was diagnostic testing for osteoporosis in the form of a BMD scan or prescribing of osteoporosis medication, or both. These are clinically important outcomes for osteoporosis management, as BMD testing leads to the diagnosis and prescribing osteoporosis medication is one of the main aspects of treatment.

Osteoporosis: evaluations of interventions compared to no-intervention control groups

Nine studies (Bessette 2011; Ciaschini 2010; Cranney 2008; Feldstein 2006; Lafata 2007; Leslie 2012; Majumdar 2008; Roux 2013; Solomon 2007a) evaluated a single or multifaceted intervention compared to a no-intervention control. The results of these studies are summarised in Table 5 and Table 6.

The majority of the studies used combinations of interventions. All studies had a patient-directed component aiming to educate the person on the condition and remind them to see their GP to discuss its management. A GP-alerting system informing the participant's clinician on the increased risk of osteoporosis either via a patient-specific letter or via an electronic reminder was also a commonly-used component. Finally, seven out of the nine studies used distribution of educational material on osteoporosis, such as osteoporosis guidelines.

The majority of the studies reported improvements in GP behaviour and more specifically increases in BMD testing and osteoporosis medication prescribing rates.

The cluster-RCTs (Cranney 2008; Lafata 2007; Solomon 2007a) did not provide sufficient data for the re-calculation of the adjusted for clustering effect sizes for this review. Cranney 2008 used patient-directed education, GP mailed reminders and dissemination of guidelines and showed that the intervention improved BMD testing (RD 26%, rates 53.5% in intervention group versus 25.5% in control, reported adjusted OR 3.38, 95% CI 1.83-6.26, P <0.001) and osteoporosis medication prescribing rates (RD 17.7%, rates 28% in intervention group versus 10% in control, reported adjusted OR 3.45, 95% CI 1.58-7.56, P = 0.002). This was a relatively small study (270 participants in total). Lafata 2007 evaluated the use a patient-directed intervention (patient mailed reminders) alone and in combination with GP prompts and showed that the intervention resulted in little difference in outcomes (RD for BMD 10.6% and 18.1% respectively and for osteoporosis medication prescribing rates 2.7% and 3.4% respectively). The authors reported generalised estimating equation (GEE) adjusted treatment rates of 2.3% in the usual care group, 4% in the patient mailed reminders group and 3.9% in the mailed reminders with GP prompts group which were statistically significant. Solomon 2007a evaluated the effect of a brief programme of patient and/or GP education (academic detailing) and showed that the intervention resulted in no difference in the probability of the primary composite end-point (BMD testing or osteoporosis medication prescribing) between the usual care and intervention groups. The reported adjusted RR for the patient and GP intervention was 1.04 (95% CI 0.85-1.26), for the GP only intervention was 0.70 (95% CI 0.56-0.86) and for the patient only intervention was 0.90 (95% CI 0.73-1.10). These results are consistent with the small RDs (<5%) reported in Table 5 and Table 6.

From the remaining six RCT studies (Bessette 2011; Ciaschini 2010; Feldstein 2006; Leslie 2012; Majumdar 2008; Roux 2013) three studies (Feldstein 2006; Leslie 2012; Majumdar 2008) evaluating interventions aimed at both GPs and patients resulted in moderate to large effects in the investigation rates (BMD testing) and four (Ciaschini 2010; Feldstein 2006; Majumdar 2008; Roux 2013) showed moderate to large effects in the prescribing rates for osteoporosis medication. GP alerting on its own also resulted in improved GP behaviour with regards to BMD testing and osteoporosis medication prescribing according to two studies (Feldstein 2006; Leslie 2012).

Majumdar 2007, assessed the cost-effectiveness of the study Majumdar 2008, and concluded that the intervention led to a per patient cost saving of CAD 13 (USD 9) and a gain of 0.012 quality-adjusted life years.

Meta-analysis of osteoporosis studies

Meta-analysis of studies evaluating professional and patient interventions versus usual care

Five osteoporosis studies (Ciaschini 2010; Feldstein 2006; Leslie 2012; Majumdar 2008; Roux 2013) used a similar intervention, including a GP-alerting system (via a patient-specific letter or electronic reminder message) and a patient-directed intervention (including patient education and a reminder to see their GP) and provided adequate data to allow meta-analysis of the results. Three of these studies (Feldstein 2006; Leslie 2012; Majumdar 2008) assessed BMD testing as one of the main outcomes, and five (Ciaschini 2010; Feldstein 2006; Leslie 2012; Majumdar 2008; Roux 2013) evaluated the effect on osteoporosis medication prescribing rates. We pooled these studies (see Analysis 1.1; Analysis 1.2) and the results show that the combined intervention increases BMD testing rates and osteoporosis medication prescribing rates: RR 4.44 (95% CI 3.54 to 5.55; participants 3,386) for BMD and RR 1.71 (95% CI 1.50 to 1.94; participants 4,223) for medication prescribing, as shown in the Summary of findings for the main comparison.The considerable statistical heterogeneity observed in the meta-analysis for BMD testing,I^2 = 75% (P=0.02), (Analysis 1.1) could be partly due to the low BMD testing in the usual care group in the studies by Feldstein 2006 (2/1032, 0.2%) and Leslie 2012 (58/1480, 4%) compared to the study by Majumdar 2008 where BMD testing in the usual care group was 18% (24/

135). Additionally, the length of follow-up was different in the three studies (six months in the studies by Feldstein 2006 and Majumdar 2008, twelve months in the study by Leslie 2012).

The *Cochrane Handbook* recommends that "*it is often sensible to use one statistic for meta-analysis and re-express the results using a second, more easily interpretable statistic. For example, meta-analysis may often be best performed using relative effect measures (risk ratios or odds ratios) and the results re-expressed using absolute effect measures (risk differences or numbers needed to treat)*" (Deeks 2011). In view of this recommendation and also the fact that we committed in our protocol to reporting both risk ratios and risk differences whenever possible, we conducted a sensitivity analysis and reported the results of the meta-analysis using risk differences. We calculated the risk difference to be moderate for BMD testing at 17% (95% CI 15% to 19%) and modest for osteoporosis medication prescribing at 10% (95% CI 8% to 12%), confirming that the intervention improves osteoporosis guideline-consistent GP behaviour irrespective of the analysis method used to express the size of the effect.

Meta-analysis of studies evaluating professional only interventions versus usual care

Two osteoporosis studies (Feldstein 2006; Leslie 2012) evaluated the effect of a GP-alerting system (via a patient-specific letter or electronic reminder message) versus usual care on professional behaviour (BMD testing and osteoporosis medication prescribing). The interventions were sufficiently similar and provided adequate data to allow the pooling of the results (see Analysis 2.1; Analysis 2.2). The results show that the intervention probably leads to improved BMD testing rates (RR 4.75 (95% CI 3.62 to 6.24); participants 3,047) and a smaller effect with regards to osteoporosis medication prescribing rates (RR 1.52 (95% CI 1.26 to 1.84; participants 3,047), as shown in the Summary of findings 2. The certainty of evidence was downgraded due to the fact that only two studies were included in the meta-analysis, due to the relatively low number of patients and events in the study by Feldstein 2006 and also due to the considerable statistical heterogeneity observed. The statistical heterogeneity in the meta-analysis for BMD testing was I^2 = 80% (P = 0.03), (Analysis 2.1) and the heterogeneity for osteoporosis medication prescribing was I^2 = 89% (P = 0.003), (Analysis 2.2). These could not be explained by study design or differences in populations but could be partly due to the different length of follow-up (the follow up in the study by Feldstein 2006 was 6 months and in the study by Leslie 2012 was 12 months) and the relatively larger effect size in the study by Feldstein 2006. We calculated the risk difference for BMD testing to be moderate at 14% (95% CI 12% to 16%) and for osteoporosis medication prescribing small at 5% (95% CI 3% to 8%), confirming that the intervention probably improves osteoporosis guideline-consistent GP behaviour.

Osteoporosis: evaluations of interventions compared to another intervention

Eight studies (Bessette 2011; Boyd 2002; Feldstein 2006; Lafata 2007; Leslie 2012; Roux 2013; Rozental 2008; Solomon 2007a) evaluated single or multifaceted interventions compared to a different intervention control. The results of these studies are summarised in Table 7 (outcome: BMD) and Table 8 (outcome: osteoporosis medication).

Bessette 2011 showed that the more intensive intervention of including a video on osteoporosis as part of the educational material distributed to participants probably results in little or no difference in BMD testing and medication-prescribing rates (RD < 5%), and in fact in the study it resulted in slightly lower BMD testing rates in the intervention group (RD -1.1).

Boyd 2002 focused on the primary prevention of fractures and showed that an extended letter (including guidelines on treatment) to the GP may slightly improve professional behaviour (BMD testing and osteoporosis medication prescribing) compared to a standard letter (suggestion to investigate and treat); RD for BMD testing modest at 7.1% and for medication prescribing small at 4.5%. The study had a potentially high risk of bias, as it did not contain adequate information to ensure its methodological quality.

Feldstein 2006 showed that adding a patient-directed intervention (education and reminders) to GP electronic reminder messages does not increase the percentage of BMD testing or osteoporosis medication prescribing; in fact, the results were slightly better (RD 6.9% and 7.7% respectively) for the professional-only intervention.

Leslie 2012 showed that the addition of patient reminders and educational material to an intervention aimed at GPs results in little difference in professional behaviour-related outcomes (RD 1.7 and 1.8% for BMD and medication prescribing rates respectively).

Roux 2013 compared a "minimal" intervention of patient education and GP alerting with reminders (as mentioned above) to the more "intensive" version which included patient blood and BMD tests, the results of which were communicated to the patient's GP and more frequent reminders. The more intensive intervention may slightly increase osteoporosis medication prescribing rates (62.2% versus 54.9%, RD modest at 7.2%).

Rozental 2008 showed that when an orthopaedic surgeon orders a BMD test and forwards the results to the GP, there may be an improvement in the rates of osteoporosis medication prescribing (74% compared with 26%, large RD of 48%). This was in comparison with participants whose GP simply received a letter from the orthopaedic surgeon outlining guidelines for osteoporosis screening. However, this was a very small study (50 participants randomised into two intervention groups).

Two cluster randomised studies (Lafata 2007 and Solomon 2007a) did not provide sufficient data to allow data adjustment for clustering. Lafata 2007 reported that a combination of GP alerts and patient education and reminders does not result in significant differences in BMD testing and osteoporosis medication prescribing rates when compared to a patient-directed intervention (RD -7.5% and -0.7% respectively, generalised estimated equa-

tion (GEE) adjusted rates as reported by the authors for medication prescribing 3.9% versus 4%). Solomon 2007a reported that there were no significant differences between the groups with regard to the composite endpoint (BMD testing and/or osteoporosis medication prescribing). The adjusted RR reported by the authors were 0.70 (95% CI 0.56-0.86) for the GP only intervention versus 0.90 (95% CI 0.73-1.10) for the patient intervention group versus 1.04 (95% CI 0.85-1.26) for the combined intervention, which are consistent with the very small RDs (<5%) presented in Table 7 and Table 8.

Meta-analysis of studies evaluating professional only interventions versus professional and patient interventions

The studies by Feldstein 2006 and Leslie 2012 were sufficiently similar and provided adequate data to allow a meta-analysis assessing the effect of adding a patient-directed component to a professional only intervention (see Analysis 3.1; Analysis 3.2). The results show that the combined intervention probably does not lead to an improved effect with regards to increasing BMD testing rates (RR 0.94. (95% CI 0.81 to 1.09); participants 2995) and osteoporosis medication prescribing rates (RR 0.93 (95% CI 0.79 to 1.10; participants 2,995), as shown in the Summary of findings 3. The certainty of evidence was downgraded because only two studies were included in the meta-analysis, one of which had a small number of participants and events.

We calculated the risk difference for BMD testing to be -1% (95% CI -4% to 2%) and for osteoporosis medication prescribing -1% (95% CI -4% to 2%), confirming that the combined intervention probably does not improve osteoporosis guideline-consistent GP behaviour when compared to a professional only intervention.

Osteoporosis studies: summary

Nine studies evaluated interventions versus no-intervention controls to improve the management of people with or at high risk of developing osteoporosis. All studies evaluated a combined intervention addressed to both the GP and the patient. Three out of the six RCT studies (Feldstein 2006; Leslie 2012; Majumdar 2008) showed moderate to large effects in the investigation rates (BMD testing) and four (Ciaschini 2010; Feldstein 2006; Majumdar 2008; Roux 2013) moderate to large effects in the osteoporosis medication prescribing rates.

Meta-analysis of three studies on BMD testing (Feldstein 2006; Leslie 2012; Majumdar 2008) and five studies on medication prescribing (Ciaschini 2010; Feldstein 2006; Leslie 2012; Majumdar 2008; Roux 2013) showed that a combination of a GP-alerting system (via a letter or educational reminder message (ERM)) and a patient-directed intervention (including patient education and a reminder to see their GP) improves guideline-consistent GP behaviour (Analysis 1.1 and Analysis 1.2). Meta-analysis of two studies (Feldstein 2006; Leslie 2012) showed that GP alerting on its own also probably improves osteoporosis guideline-consistent GP behaviour Analysis 2.1; Analysis 2.2) and that adding the patient-directed component probably does not lead to a greater effect (Analysis 3.1; Analysis 3.2).

The results of three studies (Bessette 2011; Boyd 2002; Roux 2013) suggest that more intensive interventions may result in little or no improvement in GP behaviour-related outcomes. One study (Solomon 2007a) showed that a brief educational intervention addressed at GPs (academic detailing) and patients may not result in improvements compared to usual care.

Low back pain studies:

We found 10 studies evaluating interventions on the management of low back pain (Becker 2008; Bishop 2006; Dey 2004; Eccles 2001; Engers 2005; French 2013; Hazard 1997; Hollingworth 2002; Kerry 2000; Schectman 2003) of which five were cluster-RCTs (Dey 2004; Engers 2005; French 2013; Kerry 2000; Schectman 2003), two were individual RCTs (Bishop 2006; Hazard 1997), two were cluster randomised trials (without control group) (Becker 2008; Eccles 2001) and one was an interrupted time series (Hollingworth 2002). Four studies were conducted in the UK (Dey 2004; Eccles 2001; Hollingworth 2002; Kerry 2000), two in the USA (Hazard 1997; Schectman 2003), one in Germany (Becker 2008), one in Canada (Bishop 2006), one in the Netherlands (Engers 2005) and one in Australia (French 2013).

Low back pain studies: evaluations of interventions compared to a no-intervention control group

Seven studies (Bishop 2006; Dey 2004; Engers 2005; French 2013; Hazard 1997; Kerry 2000; Schectman 2003) used a control group. The re-calculated effect sizes for those studies where the data allowed us to re-calculate the effects are summarised in Table 9.

Different combinations of interventions were used in each study, preventing us from pooling the results. All studies used dissemination of educational materials as a component of their intervention. Five studies used some form of educational meeting/educational outreach. The outcomes measured varied widely and included GP behaviour-related outcomes, such as guideline-consistent advice and x-ray requests, and patient-related outcomes, such as pain scores.

Bishop 2006 compared GP education (guidelines) and three patient-specific reminder letters to GPs versus GP and patient education and reminders versus a control group. Several outcomes were measured assessing professional behaviour (clinician adherence to the guidelines) and for the majority of these outcomes the study showed that the interventions may lead to little or no improvements (RD < 5%).

Dey 2004 showed that outreach visits to GP practices to promote national guidelines on acute low back pain were unsuccessful in changing GP behaviour with regard to ordering x-rays, issuing sickness certificates and prescribing opioids. Access to fast-track physiotherapy and a back-pain triage unit seemed to result in more referrals (RD 12.6%).

Engers 2005 showed that a complex intervention including the Dutch low back pain management guideline dissemination, a two-hour workshop, two scientific articles, additional guidance on low back pain management for occupational physicians, a patient-ed-

ucation tool and a management-decision tool may be unsuccessful in improving GP behaviour with regard to prescribing and advising the patient, but may lead to reduced onward referrals to a therapist at follow-up (RD 39.2%, 36% in the intervention group versus 76% in the control group, clustered adjusted OR 0.2, 95% CI (0.1 to 0.6)). These results were self-reported and there is therefore some risk of bias. The study did not provide adequate data to allow the re-calculation of effect sizes taking into account the effect of clustering.

French 2013 used interactive, educational workshops aiming to facilitate GP behavioural change and the dissemination of educational materials in the form of a DVD. It showed that the intervention may lead to little or no difference in the number of x-ray and CT requests (RD -0.2% and 0.0% respectively).The study had a potentially high risk of bias, as its primary outcomes (patient-related outcomes) were not measured and GP behaviour-related outcomes were reported instead.

Hazard 1997 used a risk stratification tool alerting GPs of patients at high risk of disability, and disseminated guidance on low back pain management. The study was very small (just 53 participants) and showed that the intervention may result in no improvement in patient-related outcomes (absence from work, RD -4.6%).

Kerry 2000 compared an intervention group (dissemination of guidelines on the use of radiology and audit/feedback on numbers of radiological referrals) to a control group of practices, and reported on GP behaviour-related outcomes (numbers of spinal x-ray requests over a year). The study did not report the means and standard deviations but showed a cluster-adjusted reduction of spinal x-ray requests of 20% between the intervention and control groups (95% CI 4 to 36, P<0.05). There was no assessment of the impact on the quality of these requests and their concordance with the guidelines.

Schectman 2003 compared an intervention including guideline dissemination on low back pain, a 90-minute educational session delivered by local opinion leaders and two audit/feedback reports summarising GP performance to a control group, part of which had access to patient education materials (pamphlet and video). The intervention may result in little or no improvement in guideline-consistent GP behaviour. There was no statistically significant change in GP behaviour with regard to the utilisation of individual services, which were the main outcome measures used in the study, and the RDs were small (RD < 5%) across all outcomes including guideline-consistent behaviour. Additionally, the initial four groups of the study were collapsed into two (GP intervention versus no GP intervention), after analysis of the impact of the patient-education component of the intervention revealed no effect on clinical service utilisation. This retrospective pooling of the results and the possibility of contamination between the groups may have introduced bias.

In summary, the studies on back pain used interventions with multiple components, mainly including dissemination of educational materials and educational meetings/outreach, and showed that these interventions may result in little or no improvement in GP behaviour and patient-related outcomes (Bishop 2006; Dey 2004; Engers 2005; French 2013; Hazard 1997; Schectman 2003). The combination of guidelines and audit/feedback may result in a slight reduction in spinal radiology requests according to one study (Kerry 2000).

Low back pain studies: evaluations of interventions compared to another intervention

Three low back pain studies (Becker 2008; Bishop 2006; Eccles 2001) compared one intervention against a different intervention. The results of these studies are summarised in Table 10 (dichotomous data) and Table 11 (continuous data).

Becker 2008 assessed the effect of GP education using guideline dissemination, three seminars and academic detailing (guideline implementation, GI group) versus a 'control group' which only received guidelines by mail and versus GP education plus practice-nurse motivational counselling plus guidelines (motivational counselling, MC group). The study showed that the intervention resulted in little or no improvement with respect to the majority of patient-related outcomes (functional capacity, overall activity, days of sick leave and quality of life) compared to the guideline dissemination only group. The main statistically and clinically significant improvements were with regards to fewer days in pain at 6 months for both GI and MC intervention groups (SMD 0.2, mean difference -16.4, 95% CI (-26.8 to -6), P = 0.002 for the GI and SMD 0.2, mean difference -17.9, 95% CI (-28.2 to -7.6), P = 0.001 for the MC group) and at 12 months for the GI group (SMD 0.2, mean difference -12.8, 95% CI (-23.4 to -2.3), P = 0.018). There was only a small absolute and clinical difference between the GI and MC group means without consistent improvement in one group over the other across outcomes (Table 11).

Bishop 2006 showed that the added intervention of providing participants with lay-language versions of the guidelines may not alter GP guideline-consistent behaviour, with the only moderate improvement occurring with respect to the recommendations regarding aerobic exercise (RD 15%).

Eccles 2001 assessed the effect of audit/feedback and reminder messages on primary care knee and spinal radiology referrals. The study evaluated three intervention groups versus a 'control' group which only received guidelines. The first intervention group received feedback on the number of radiographs requested in the six months before and after the intervention. The second intervention group received educational reminder messages (ERMs) on all radiograph reports. The third intervention group received both feedback and reminders. All groups, including the 'control' group, received referral guidelines. The study showed that there may be some deterioration in the percentage of spinal radiographs which are concordant with the guidelines in the intervention groups (RD range -2.5% to -8.3%, Table 10) and a slight reduction in the number of spinal radiograph requests across the groups (SMD small for the feedback group at 0.2 and moderate for the reminder group at 0.4) as seen in Table 11. The authors of this study recom-

mended caution in the interpretation of the data, due to a baseline imbalance between the study groups. Ramsey 2003 reported on the effect of the educational reminder messages over the 12 months after the intervention by Eccles 2001. It showed that there was a small but sustained reduction in the number of spinal radiographs in the reminder group compared to the guideline-only group (reported RR = 0.64, 95% CI (0.43 to 0.96), P=0.029).

Low back pain studies: evaluation of interventions using interrupted time series

Hollingworth 2002 used interrupted times series to evaluate the impact of guideline dissemination on the use of lumbar spine radiography by GPs. The study did not report the mean number of radiographs at the different time periods (the trend was presented in a graph form). The study showed that the intervention may lead to no improvement in the referral patterns for radiography of the lumbar spine.The outcomes of the study are summarised in Table 12.

Low back pain studies: summary

In summary, the 10 studies on low back pain showed that interventions including guideline dissemination, educational reminders and face-to-face educational opportunities for GPs may lead to little or no improvement with regard to changing professional behaviour. Guidelines on their own may lead to little or no difference (Hollingworth 2002), while a combination of guidelines and educational meetings/outreach may result in little or no improvement (Becker 2008; Bishop 2006; Dey 2004; Engers 2005; French 2013; Hazard 1997; Schectman 2003). The combination of guidelines and audit/feedback may result in a slight reduction in radiology requests (Eccles 2001; Kerry 2000). The combination of guidelines and GP reminders may result in a slight, sustained reduction in the number of radiology requests but no improvement in their quality, as shown in Eccles 2001.

Osteoarthritis studies:

Four studies included people with osteoarthritis (Chassany 2006; Rahme 2005; Rosemann 2007; Stross 1985). All were cluster-RCTs. One study was conducted in the USA (Stross 1985), one in France (Chassany 2006), one in Germany (Rosemann 2007), and one in Canada (Rahme 2005). The reported outcomes varied amongst the studies and included patient-related outcomes (pain control) and GP behaviour-related outcomes (prescribing of medication and onward referrals for radiographs, physical therapy or arthroplasty).

Osteoarthritis: evaluations of interventions compared to a no-intervention control group

All four studies assessed a single or multifaceted intervention compared to a no-intervention control group. The results of these studies are summarised in Table 13; and Table 14.

Chassany 2006 evaluated the effect of a four-hour interactive training session for GPs on relationships and communication, pain evaluation, prescribing and negotiating a patient contract. Following the training, eight letters emphasising the recommendations were mailed to the participants. The intervention resulted in small improvements with regard to patient-related outcomes such as pain and disability scores (WOMAC index global score) (SMD <0.40, P<0.05 across all outcomes, Table 13). The relative limitation of the study was that results were assessed within two weeks of the trial, so it is unclear whether the positive patient outcomes persisted.

Rahme 2005 evaluated three intervention groups (a 90-minute interactive workshop group on osteoarthritis management, a decision tree on osteoarthritis management, and a combination of the two interventions) with a control (usual care) group. The results showed a probable slight improvement in osteoarthritis guideline-consistent GP behaviour (prescribing of medication) in all three groups. The highest RD was 13% for the combined intervention while the dissemination of educational material (decision tree) on its own resulted in a 5% RD.

Rosemann 2007 evaluated two interactive eight-hour GP meetings focusing on education and guideline dissemination with and without nurse case management, and showed some improvements with regard to GP behaviour-related outcomes (reduced referrals to orthopaedic surgeons: SMD 0.8 for the educational intervention and 0.2 for the combined intervention, reduced referrals for radiographs: SMD 0.2 and 0.4 respectively and increased prescriptions for painkillers: RDs between -2.2 and 11.1%). There were small or no improvements with regard to patient related outcomes (quality of life: SMD <0.40).

Stross 1985 evaluated a complex intervention which was delivered by educationally influential physicians (EIs) and targeted GPs. It comprised a self-study programme including textbook, audiovisual materials and recent articles on osteoarthritis. This was a small study and showed that the intervention may improve guideline-consistent GP behaviour by increasing the intra-articular corticosteroids (RD large at 29%) and reducing the use of systemic corticosteroids (RD moderate at 19%) in osteoarthritis patients. There were small reductions in the length of stay (MD 0.2 days for osteoarthritis and 0.8 days for total hip arthroplasty, Table 13). In those patients undergoing total hip arthroplasty, there may be an increase in the utilisation of physical therapy pre-operatively (RD large at 57%).

Osteoarthritis: evaluations of interventions compared to another intervention

When comparing the three intervention groups (a 90-minute interactive workshop group on osteoarthritis management, a decision tree on osteoarthritis management, and a combination of the two interventions) in the study by Rahme 2005, the combined intervention resulted in modest improvements in GP behaviour (medication prescribing) compared to the single faceted interventions (Table 15).

There was little or no difference with regard to the prescriptions of painkillers (RD < 5.9%, Table 15), referrals to other services (SMD <0.20 for the majority of outcomes, Table 16) and patient related outcomes (quality of life) (SMD <0.20, Table 16) with the addition of nurse case management in the study by Rosemann

2007.

Osteoarthritis studies: summary

Educational sessions, workshops and guidelines on the management of osteoarthritis were the main interventions evaluated, and they may result in some positive changes in GP behaviour and patient-related outcomes. Chassany 2006 showed that the intervention may result in little improvement in patient outcomes (pain and disability) after training GPs in pain evaluation, management and communication. Rahme 2005 and Stross 1985 showed modest improvements in GP prescribing after clinician education, but the results were not confirmed in Rosemann 2007. Stross 1985 delivered the educational intervention via local educationally influential physicians and showed that it may lead to an improvement in guideline-consistent GP behaviour.

Shoulder pain studies:

Three studies evaluated interventions aiming to improve the management of shoulder pain by GPs (Broadhurst 2007; Gormley 2003; Watson 2008). The studies were set in Australia (Broadhurst 2007), Northern Ireland (Gormley 2003), and the UK (Watson 2008). Broadhurst 2007 was a controlled before-and-after (CBA) study with two intervention and two control groups, while Gormley 2003 was a randomised controlled trial (RCT) and Watson 2008 a cluster-RCT. All studies used educational interventions in the format of meetings or educational outreach.

Shoulder pain: evaluations of interventions compared to a no-intervention control group

Broadhurst 2007 evaluated the effect of academic detailing on the management of shoulder pain and recorded the number of shoulder x-rays and ultrasound scans before, during and after the intervention. The time-adjusted rates of imaging requests were reported, but not the absolute numbers, means or standard deviations. There was no evidence to suggest a change in the rate of x-ray requests over the different time periods between the intervention and the control groups (P = 0.11). Requests for ultrasound imaging were approximately 43.8% higher in the period two years before academic detailing compared to six months after in the academic detailing group, but an upward trend towards the baseline was observed in the period six months to one year after the intervention. The intervention may result in a temporary, slight reduction in ultrasound requests, but little or no change in the x-ray requests.

Watson 2008 reported on the SAPPHIRE randomised controlled trial (Table 17). The intervention consisted of a 60-minute lecture on shoulder disorders, summarised handouts and training in injection techniques. The main outcomes reported were patient-related (pain and disability assessed by the British Shoulder Disability questionnaire (BSDQ) and the Short-form 36 item (SF-36) Health Survey). The intervention may result in little or no improvement in pain and disability a year later (BSDQ SMD 0.2, SF-36 for physical component SMD 0 and SF-36 mental component SMD 0.1). McKenna 2009 assessed the cost-effectiveness of providing practical training to GPs in the SAPPHIRE study. It reported an incremental cost-effectiveness ratio of GBP 2813 per QALY gained for trained GPs.

Shoulder pain: evaluations of interventions compared to another intervention

Gormley 2003 evaluated the impact of two different types of shoulder injection training (on mannequins versus mannequins and real patients) for GPs, and reported the effects on professional behaviour, i.e. the number of shoulder injections performed and the number of referrals to injection or physiotherapy clinics. The results are summarised in Table 18. Additional training with real patients may result in an increase in the number of injections performed by GPs (adjusted relative percentage change 44%, P=0.02) and a reduction in the rates of onward referrals (adjusted relative percentage change 38-100%, not statistically significant).

Shoulder studies: summary

The studies were heterogeneous in terms of design, type of intervention and outcomes. Broadhurst 2007 showed that academic detailing may result in a temporary, slight reduction of shoulder ultrasound scans, but little or no change in the x-ray requests. Watson 2008 showed there may be little or no improvement in patient-reported outcomes after education of GPs on shoulder pain management and injection training. Gormley 2003 showed that additional training with real patients may increase the number of shoulder injections performed by GPs.

Other musculoskeletal conditions studies:

Four studies focused on musculoskeletal conditions other than the ones mentioned above (Eccles 2001; Huas 2006; Kerry 2000; Robling 2002). Eccles 2001 and Kerry 2000 have been mentioned above under the low back pain studies, as they also reported on low back pain outcomes. All studies were cluster-randomised trials. Three of the studies (Eccles 2001; Kerry 2000; Robling 2002) were set in the UK and one (Huas 2006) was conducted in France. The outcomes of these studies are summarised in Table 19; Table 20; Table 21.

Other musculoskeletal conditions: evaluations of interventions compared to a no-intervention control group

Huas 2006 evaluated the impact of training GPs on the use of two validated assessment scales (the VAS pain scale and the HAD anxiety and depression scale). The intervention may result in worse patient-related outcomes: pain relief scores (SMD 2, P=0.0004) and increased level 3 (WHO classification) analgesic prescribing (SMD 1.2, P=0.02).

Kerry 2000, as mentioned above, used dissemination of guidelines on the use of radiology and GP audit/feedback on numbers of radiological referrals. The study did not report the means and standard deviations. Overall a 1% reduction in the numbers of limb and joint x-ray requests was observed in the intervention group compared to a 9% increase in the control group (giving a total of 10% difference), but this did not achieve statistical significance (95% CI -5 to 25). Overall, the intervention therefore may result in a little or no reduction in GP radiology referrals.

Other musculoskeletal conditions: evaluations of interventions com-

pared to another intervention

Eccles 2001 was discussed above as part of the low back pain studies. However, it also looked at knee radiographs. Educational reminder messages may result in a slight improvement in concordance of the requests with guidelines (RD 5.3, Table 20). Audit/feedback and educational reminder messages used separately and in combination may show a slight reduction in the number of knee radiograph requests per 1000 patients, as seen in Table 21 (SMD 0.2, 0.50, and 0.50 respectively). The authors of this study recommended caution in the interpretation of the data, due to a baseline imbalance between the study groups. Ramsey 2003 reported on the effect of the educational reminder messages over the 12 months after the intervention by Eccles 2001. It showed that there was a small but sustained reduction in the number of knee radiographs in the reminder group compared to the guideline-only group (reported RR = 0.65, 95% CI (0.46 to 0.91), P= 0.011).

Robling 2002 evaluated different combinations of guideline dissemination on knee and lumbar spine magnetic resonance imaging (MRI), practice-based seminar and audit/feedback on MRI use, and comparative data on orthopaedic and neurosurgical referrals. The results for both knee and spine MRIs were reported together and therefore the study is not mentioned under the low back pain studies. The results (summarised in Table 20) show that the interventions may result in no difference in guideline-concordant GP behaviour (guideline-concordant requests for MRIs (RD -12.1 to 12.1)). A cost-effectiveness analysis showed that accessing the MRI service in writing is probably more cost effective compared to telephone access, and dissemination of guidelines is probably more cost effective compared to the other types of intervention used.

Other musculoskeletal conditions: summary

The four studies on other musculoskeletal conditions were heterogeneous in terms of intervention types and outcomes assessed. Huas 2006 showed that GP training in the use of validated assessment scales may result in worse pain control and increased prescribing of strong (level 3) painkillers. Eccles 2001 showed that educational reminder messages attached to radiographic reports may result in a slight but sustained reduction in knee radiographs. Kerry 2000 and Eccles 2001 showed that providing GP feedback on the total number of investigations requested may result in a slight reduction in the number of radiology requests.

Additional analysis

Does the effectiveness of interventions vary depending on the direction of behaviour targeted?

Some of the interventions aimed to increase a clinical behaviour (e.g. bone density testing) while others aimed to decrease certain clinical actions (e.g. x-ray requests discordant with guidelines). We examined whether the effectiveness of the interventions varied depending on the direction of the targeted behaviour. The results are presented in Table 22. The median absolute effect size for comparisons that aimed to increase a behaviour was 5 (interquartile range (IQR) 0.6 to 12.6) compared to 1.1 (IQR -1.1 to 3) for comparisons that aimed to decrease an existing behaviour (T-test < 0.05).

The above seem to suggest that it may be more challenging for an intervention to reduce an existing behaviour rather than to increase a behaviour that is underused. However, as highlighted in the review by French 2010, a difference in intervention effects may be "due to factors inherent in the management of osteoporosis and low back pain rather than due to increasing or decreasing behaviours per se". Therefore, in order to investigate the above study characteristic further, we undertook a subgroup analysis by condition. None of the osteoporosis studies included comparisons aiming to decrease a clinical behaviour and they were therefore excluded from the condition-specific subgroup analysis. The results for the low back pain and osteoarthritis studies are presented in Table 23 and Table 24 respectively and show no significant difference between the median absolute effect sizes (T-test = 0.297 for low back pain and T-test=0.70 for osteoarthritis). The available data therefore do not support the notion that increasing a behaviour is more or less challenging than reducing an existing behaviour.

ADDITIONAL SUMMARY OF FINDINGS [Explanation]

Primary care physician alerting system compared to usual care for osteoporosis management

Patient or population: General practitioners/family doctors involved in the management of patients with osteoporosis
Settings: Primary care
Intervention: Primary care physician alerting system
Comparison: Usual care

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Certainty of the evi- dence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Usual care	Primary care physician alerting system				
Bone mineral density[1] Follow-up: 6-12 months	Study population		RR 4.75 (3.62 to 6.24)	3047 (2 studies)	⊕⊕⊕⊖ Moderate[3]	
	38 per 1000	302 per 1000 (64 to 1000)				
	Moderate					
	29 per 1000	231 per 1000 (49 to 1000)				
Osteoporosis medica- tion[2] Follow-up: 6-12 months	Study population		RR 1.52 (1.26 to 1.84)	3047 (2 studies)	⊕⊕⊕⊖ Moderate[3]	
	102 per 1000	268 per 1000 (67 to 1000)				
	Moderate					
	77 per 1000	202 per 1000 (50 to 809)				

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence interval; **RR:** Risk ratio;

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] Bone mineral density (BMD) testing is an important outcome for osteoporosis because it leads to the diagnosis of the condition. This is one of the GP behaviour-related outcomes (primary outcome)

[2] Osteoporosis medication prescribing is an important outcome for osteoporosis management as it is the main aspect of treatment. This is one of the GP behaviour-related outcomes (primary outcome)

[3] The quality of evidence was downgraded because only two studies were included, one of which had a small number of participants and events, and in view of the considerable statistical heterogeneity observed.

Primary care physician alerting system compared to Primary care physician alerting system and a patient-directed intervention (education and reminder to see their primary care physician) for osteoporosis management

Patient or population: General practitioners/family doctors involved in the management of patients with osteoporosis
Settings: Primary care
Intervention: Primary care physician alerting system
Comparison: Primary care physician alerting system and a patient-directed intervention (education and reminder to see their primary care physician)

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Certainty of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Primary care physician alerting system and a patient-directed intervention (education and reminder to see their primary care physician)	Primary care physician alerting system				
Bone mineral density[1] Follow-up: 6-12 months	**Study population**		**RR 0.94** (0.81 to 1.09)	2995 (2 studies)	⊕⊕⊕⊖ **moderate**[3]	
	192 per 1000	**194 per 1000** (123 to 261)				
	Moderate					
	254 per 1000	**257 per 1000** (163 to 345)				
Medication[2] Follow-up: 6-12 months	**Study population**		**RR 0.93** (0.79 to 1.10)	2995 (2 studies)	⊕⊕⊕⊖ **moderate**[3]	
	167 per 1000	**176 per 1000** (115 to 264)				
	Moderate					

	182 per 1000	**191 per 1000** (126 to 288)	

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence interval; **RR:** Risk ratio;

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] Bone mineral density (BMD) testing is an important outcome for osteoporosis because it leads to the diagnosis of the condition. This is one of the GP behaviour-related outcomes (primary outcome)

[2] Osteoporosis medication prescribing is an important outcome for osteoporosis management as it is the main aspect of treatment. This is one of the GP behaviour-related outcomes (primary outcome)

[3] The quality of evidence was downgraded because only two studies were included, one of which had a small number of participants and events.

Professional interventions for GPs on the management of osteoporosis compared to usual care

Patient or population: General practitioners/family doctors involved in the management of patients with osteoporosis
Settings: Primary care
Intervention: Professional interventions (targeting physician-only)
Comparison: Usual care

Outcomes	Impact (including effect sizes wherever available)	Number of Participants (studies)	Certainty of the evidence (GRADE)	Comments
Health professional (GP) behaviour-related outcomes • Bone Mineral Density (BMD) testing • Osteoporosis medication (appropriate prescribing)	• BMD **RR 4.75** (95% CI 3.62 to 6.24) • Osteoporosis medication **RR 1.52** (95% CI 1.26 to 1.84)	• BMD 3047 (2 studies) • Osteoporosis medication 3047 (2 studies)	• BMD ⊕⊕⊖ **moderate**[1] • Osteoporosis ⊕⊕⊖ **moderate**[1]	
Patient **outcomes** • Fragility fractures • Hospitalisation				None of the included studies assessed these outcomes
Economic outcomes • Health service costs (including prescribing costs) • Cost effectiveness	Majumdar 2007, assessed the cost effectiveness of the study Majumdar 2008, and concluded that the intervention led to a per patient cost saving of CAD 13 (USD 9) and a gain of 0.012 quality-adjusted life years	272 participants (1 study)	⊕⊕⊖⊖ **low**[2]	

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence Interval; **RR:** Risk Ratio

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1]The quality of evidence was downgraded because only two studies were included, one of which had a small number of participants and events, and in view of the considerable statistical heterogeneity observed.
[2] The quality of evidence was downgraded because only one study was included which had some risk of bias.

Professional interventions for GPs on the management of low back pain compared to usual care

Patient or population: General practitioners/family doctors involved in the management of patients with low back pain
Settings: Primary care
Intervention: Professional interventions (targeting physician-only)
Comparison: Usual care

Outcomes	Impact (including effect sizes wherever available)	No of studies	Certainty of the evidence (GRADE)	Comments
Health professional (GP) behaviour-related outcomes				
Guideline-consistent advice during consultation	Bishop 2006 showed that the intervention may result in little or no improvements (RD < 10%) with regard to guideline-consistent advice about exercise, return to work and education and reassurance Dey 2004 showed that the intervention probably results in a small reduction of sickness certification (RD 1.3) Engers 2005 showed that the intervention may lead to no improvement of GP behaviour with regards to patient education and advice during the consultation (RD range (-1.3 to 12.8), authors reported OR ranging between 0.4 and 2.9)	3	⊕⊕⊖⊖ **low**[1]	

Guideline-consistent prescribing of medication	Bishop 2006 showed that the intervention may lead to little improvements (RD < 10%) with regards to guideline-consistent medication prescribing Dey 2004 showed that the intervention probably results in no difference on prescribing rates of opioids (RD -1.3) Engers 2005 showed that the intervention may result in no improvement of GP behaviour with regard to prescribing (RD=2.8, OR=1, 95% CI (0.3 to 3), reported as not statistically significant)	3	⊕⊕⊖⊖ **low**[1]
Guideline-consistent referrals for investigations (e.g.. x-rays)	Schectman 2003 showed that the intervention may result in little or no change in GP behaviour with regards to the number of guideline-consistent referrals for lumbar spine x-rays and CT scans (RD <5%)	1	⊕⊕⊖⊖ **low**[2]
Guideline-consistent referrals to other services	Bishop 2006 showed that the intervention may lead to little or no improvements (RD < 5%) with regards to guideline-consistent referral to other services (such as physiotherapy) Schectman 2003 showed that the intervention may result in little or no difference with regards to the number of guideline-consistent special-	2	⊕⊕⊖⊖ **low**[3]

	ist or physiotherapy referrals (RD <5%)		
Number of investigations	Dey 2004 showed that the intervention probably results in a small increase in the ordering of x-rays (RD 1.4) French 2013 showed that the intervention may lead to little or no difference in the number of x-ray and CT requests (RD -0.2% and 0.0% respectively) Kerry 2000 showed that the intervention probably results in a cluster-adjusted reduction of spinal x-ray requests of 20% between the intervention and control groups (95% CI 4 to 36, P<0.05) Schectman 2003 showed that the intervention may result in little or no change in GP behaviour with regards to referrals for lumbar spine x-rays and CT scans (RD <5%)	4	⊕⊕⊖⊖ **low**[4]
Number of referrals to other services	Dey 2004 showed that the intervention probably results in increased referrals to fast-track physiotherapy and a back-pain triage service (RD 12.6%) Engers 2005 showed that the intervention may lead to little reduction of onward referrals to a therapist (RD 4.6, 23% in the intervention group versus 28% in the control group, clustered adjusted OR 0.8, 95% CI (0.5 to 1.4))	3	⊕⊕⊖⊖ **low**[4]

	Schectman 2003 showed that the intervention may result in little or no difference with regards to the number of specialist or physiotherapy referrals (RD <5%)			
Patient outcomes				
Functional capacity/activity scores		0		None of the included studies assessed this outcome
Pain control		0		None of the included studies assessed this outcome
Work absence	Hazard 1997 showed that the intervention may result in no improvement with respect to days of sick leave compared to the control group (RD -4.6%)	1	⊕⊕⊖⊖ **low**[2]	The study by Hazard 1997 was very small (just 53 participants)
Quality of life		0		None of the included studies assessed this outcome
Economic outcomes • Health service costs (including prescribing costs) • Cost effectiveness		0		None of the included studies assessed these outcomes

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
RD: Risk Difference **SMD:** Standardised Mean Difference **CI:** Confidence Interval; **RR:** Risk Ratio

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] The quality of evidence was downgraded because the studies have a high risk of bias and high heterogeneity in terms of the types of interventions evaluated. Additionally the effect sizes are small.
[2] The quality of evidence was downgraded because the results are based only on one study with high risk of bias.

[3] The quality of evidence was downgraded because the results are based on just two studies with high risk of bias.
[4] The quality of evidence was downgraded because the studies have a high risk of bias and high heterogeneity in terms of the types of interventions evaluated. Additionally there is high inconsistency in the direction of effects across the studies.

Professional interventions for GPs on the management of osteoarthritis compared to usual care

Patient or population: General practitioners/family doctors involved in the management of patients with osteoarthritis
Settings: Primary care
Intervention: Professional interventions (targeting physician-only)
Comparison: Usual care

Outcomes	Impact (including effect sizes wherever available)	No of studies	Certainty of the evidence (GRADE)	Comments
Health professional (GP) behaviour-related outcomes				
Guideline-consistent advice during consultation	Stross 1985 showed that the intervention may increase the use of intra-articular corticosteroids (RD large at 29%)		⨁⨁◯◯ **low**[1]	
Guideline-consistent prescribing of medication	Rahme 2005 showed that the intervention may result in a slight improvement in osteoarthritis guideline-consistent GP prescribing of medication (acetaminophen, NSAIDs and COX-2 inhibitors) 5 months afterwards (RD 5% after dissemination of educational material, RD 7% after a workshop and RD 13% for the combined intervention) Rosemann 2007 showed that prescriptions for painkillers may slightly increase following the intervention (RDs between -2.		⨁⨁◯◯ **low**[1]	

	2% and 11.1%) Stross 1985 showed that the intervention may reduce the use of systemic corticosteroids according to the guidelines (RD moderate at 19%)		
Guideline-consistent referrals for investigations (e.g.. x-rays)			None of the included studies assessed this outcome
Guideline-consistent referrals to other services	Stross 1985 showed that the intervention may increase the utilisation of physical therapy pre-operatively (RD large at 57%)	⊕⊕⊖⊖ **low**[1]	
Number of investigations	Rosemann 2007 showed that the intervention may result in some small reduction in the number of GP referrals for radiographs (SMD 0.2-0.4)	⊕⊕⊖⊖ **low**[3]	
Number of referrals to other services	Rosemann 2007 showed that the intervention may result in a reduction in the number of GP referrals to orthopaedics (SMD 0.8 for the educational intervention and 0.2 for the combined intervention after adding nurse case management)	⊕⊕⊖⊖ **low**[4]	
Patient outcomes			
Functional capacity/activity scores	Chassany 2006 showed that the intervention may result in small improvements with regard to physical function scores (WOMAC index physical function	⊕⊕⊖⊖ **low**[5]	Results were assessed within two weeks of the Chassany 2006 trial, so it is unclear whether the positive patient outcomes persisted

	score) (SMD 0.3, P<0.05)		
Pain control	Chassany 2006 showed that the intervention may result in small improvements with regard to pain scores (VAS score, Pain relief (SPID), WOMAC index pain score) (SMD 0.2, P<0.05 across all outcomes)	⊕⊕⊖⊖ **low**[5]	Results were assessed within two weeks of the Chassany 2006 trial, so it is unclear whether the positive patient outcomes persisted
Work absence			None of the included studies assessed this outcome
Quality of life	Rosemann 2007 showed that the intervention may result in small or no improvement with regard to patient related outcomes (SMD <0.40)	⊕⊕⊖⊖ **low**[3]	
Economic outcomes • *Health service costs (including prescribing costs)* • *Cost effectiveness*			None of the included studies assessed these outcomes

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
RD: Risk Difference **SMD:** Standardised Mean Difference **CI:** Confidence Interval; **RR:** Risk Ratio

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] The quality of evidence was downgraded because the results are based on one study only with high risk of bias and a small number of participants (114).
[2] The quality of evidence was downgraded because the studies have high heterogeneity in terms of the types of interventions and the types of medications prescribed.
[3] The quality of evidence was downgraded because the results are based on just one study and the effect size was small.
[4] The quality of evidence was downgraded because the results are based on just one study and the effect size varies considerably between the two intervention groups.

[5] The quality of evidence was downgraded because the results are based on just one study and were assessed just 2 weeks following the intervention.
NSAIDs: Non steroidal anti-inflammatory drugs, COX-2 inhibitors: Cyclo-oxygenase 2 inhibitors, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, VAS: Visual analogue scale, SPID: sum of pain intensity differences.

Professional interventions for GPs on the management of shoulder pain compared to usual care

Patient or population: General practitioners/family doctors involved in the management of patients with shoulder pain
Settings: Primary care
Intervention: Professional interventions (targeting physician-only)
Comparison: Usual care

Outcomes	Impact (including effect sizes wherever available)	Number of studies	Certainty of the evidence (GRADE)	Comments
Health professional (GP) behaviour-related outcomes				
Guideline-consistent advice during consultation				None of the included studies assessed this outcome
Guideline-consistent prescribing of medication				None of the included studies assessed this outcome
Guideline-consistent referrals for investigations (e.g.. x-rays)				None of the included studies assessed this outcome
Guideline-consistent referrals to other services				None of the included studies assessed this outcome
Number of investigations	Broadhurst 2007 showed that the intervention may result in a temporary, slight reduction in ultrasound requests, but little or no change in the x-ray requests		⊕⊕⊖⊖ **low**[1]	
Number of referrals to other services				None of the included studies assessed this outcome

Patient outcomes			
Functional capacity/activity scores	Watson 2008 showed that the intervention may result in little or no improvement in function a year later (BSDQ SMD 0.2, SF-36 for physical component SMD 0 and SF-36 mental component SMD 0.1)	⊕⊕⊖⊖ **low**[2]	
Pain control			None of the included studies assessed this outcome
Work absence			None of the included studies assessed this outcome
Quality of life			None of the included studies assessed this outcome
Economic outcomes • *Health service costs (including prescribing costs)* • *Cost effectiveness*	McKenna 2009 assessed the cost effectiveness of providing practical training to GPs in the SAPPHIRE study by Watson 2008. It reported an incremental cost-effectiveness ratio of GBP 2,813 per QALY gained for trained GPs	⊕⊕⊖⊖ **low**[2]	

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
RD: Risk Difference **SMD:** Standardised Mean Difference **CI:** Confidence Interval; **RR:** Risk Ratio

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] The quality of evidence was downgraded because the results are based on just one study (CBA) with high risk of bias.

[2] The quality of evidence was downgraded because the results are based on just one study and the effect size was small.
BSDQ: British Shoulder Disability questionnaire, SF-36: Short-form 36 item Health Survey, GBP: Great Britain Pound

Professional interventions for GPs on the management of shoulder pain compared to usual care

Patient or population: General practitioners/family doctors involved in the management of patients with other musculoskeletal conditions
Settings: Primary care
Intervention: Professional interventions (targeting physician-only)
Comparison: Usual care

Outcomes	Impact (including effect sizes wherever available)	No of studies	Certainty of the evidence (GRADE)	Comments
Health professional (GP) behaviour-related outcomes				
Guideline-consistent advice during consultation				None of the included studies assessed this outcome
Guideline-consistent prescribing of medication	Huas 2006 showed that the intervention may result in increased level 3 (WHO classification) analgesic prescribing (SMD 1.2, P=0.02)		⊕⊕⊖⊖ **low**[1]	
Guideline-consistent referrals for investigations (e.g.. x-rays)				None of the included studies assessed this outcome
Guideline-consistent referrals to other services				None of the included studies assessed this outcome
Number of investigations	Kerry 2000 showed that the intervention may result in little or no reduction in GP knee radiology requests (relative change 10%, not statistically significant)		⊕⊕⊖⊖ **low**[2]	
Number of referrals to other services				None of the included studies assessed this outcome

Patient outcomes			
Functional capacity/activity scores			None of the included studies assessed this outcome
Pain control	Huas 2006 showed that the intervention may result in worse patient-related outcomes: pain relief scores (SMD 2, P= 0.0004)	⊕⊕⊖⊖ **low**[1]	
Work absence			None of the included studies assessed this outcome
Quality of life			None of the included studies assessed this outcome
Economic outcomes • *Health service costs (including prescribing costs)* • *Cost effectiveness*			None of the included studies assessed these outcomes

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
RD: Risk Difference **SMD:** Standardised Mean Difference **CI:** Confidence Interval; **RR:** Risk Ratio

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] The quality of evidence was downgraded because the results are based on just one study with high risk of bias.
[2] The quality of evidence was downgraded because the results are based on just one study and the effect size was small.

DISCUSSION

We included thirty studies assessing a range of professional interventions targeting GPs/family doctors and aiming to improve the management of musculoskeletal conditions. Eleven studies evaluated interventions on osteoporosis, ten on low back pain, four on osteoarthritis, three on shoulder pain and four on other musculoskeletal conditions (two of these studies looked at both low back pain and other musculoskeletal conditions).

Summary of main results

For improving the management of osteoporosis, a combination of a GP-alerting system and patient education with reminders to see their GP leads to improved professional behaviour. The combined intervention increases both diagnostic testing rates for osteoporosis and medication prescribing rates. GP-alerting on its own also probably improves osteoporosis guideline-consistent professional behaviour and adding the patient-directed component probably does not lead to a greater effect.

Distribution of educational materials (including guideline dissemination) and participation in educational meetings/workshops were common components of complex interventions. Seven studies on low back pain showed that guideline dissemination and educational opportunities for GPs may lead to little or no improvement with regard to guideline-consistent GP behaviour.

Two studies showed that the combination of guidelines and GP feedback on the total number of investigations requested may result in a slight reduction in the number of tests requested, while one of these studies showed that the combination of guidelines and GP reminders attached to radiology reports may result in a small but sustained reduction in the number of requests. One study showed that using educationally influential physicians may result in improvement in guideline-consistent GP behaviour.

The direction of the targeted behavioural change does not seem to affect the effect size of interventions.

Overall completeness and applicability of evidence

We are unable to draw firm conclusions on the effectiveness of the tested professional interventions aimed at improving the management of musculoskeletal conditions by GPs/family doctors. Only five studies were sufficiently similar in terms of interventions and outcomes studied and provided adequate data to allow a meta-analysis of their results. These studies incorporated a patient-directed component in addition to a professional intervention. This additional component increases the complexity of the interventions and limits their applicability as it introduces contextual and cultural factors (e.g. linguistic and socioeconomic diversity of the patient population) which may affect the success of the intervention. Further meta-analysis of two of these studies showed that probably the professional intervention on its own is effective and that adding the patient component probably does not result in improved professional behaviour. However, further studies are required to confirm this conclusion. Additionally, the included studies did not assess the effect of the above interventions on patient related and economic outcomes.

Incomplete reporting of data and the relatively high risk of bias in the remaining studies compromised our confidence in the results. Due to the complexity of the interventions and the often inadequate intervention detail, we were unable to conduct robust subgroup analysis of the different components of interventions, so that we can confidently identify the ones associated with successful outcomes.

The majority of the studies did not investigate the potential adverse effects of the interventions. This may be because most studies aimed to improve adherence to evidence-based clinical guidelines which tend to promote clinical practice where the overall benefits outweigh the risks. Only four studies reported on work absence and service utilisation, and only three studies (Majumdar 2008; Robling 2002; Watson 2008) included a cost-effectiveness analysis.

No studies looked specifically at disadvantaged groups. The primary target of the interventions were the GPs/family doctors. The patient-directed interventions did not focus specifically on any disadvantaged groups. The applicability of such interventions to patients with a low socioeconomic status may be different, especially in countries where the patients need to contribute financially in order to access medical services.

Study locations may limit the external validity of the conclusions drawn to high-income countries only.

Quality of the evidence

We judged the quality or certainty of the evidence of the five studies included in the first meta-analysis to be high, because they were all well designed and implemented RCTs which gave consistent results with a low level of imprecision (Summary of findings for the main comparison). Our confidence in the pooled effect estimate of interventions directed to both GPs and patients for improving diagnostic testing and medication prescribing in osteoporosis is therefore high.

Our confidence in the pooled effect estimate reported in the two additional meta-analyses (Summary of findings 2; Summary of findings 3) is moderate because the analyses included only two studies, one of which was relatively small. Therefore, the certainty of the evidence was downgraded.

Our confidence in the reported effect estimates in the remaining twenty-five studies is low. Most studies had limitations in design or execution with an often unclear or high risk of associated bias which affected the certainty of the evidence. We were unable to judge the level of inconsistency for these studies, due to their wide heterogeneity in terms of types of interventions and outcomes which prevented us from comparing their effects. The heterogeneity of interventions and their combinations was also a source of indirectness, as studies were reporting on the results of a variety of intervention comparisons. Four of the studies (Gormley 2003; Hazard 1997; Rozental 2008; Stross 1985) had high levels of imprecision, including relatively few events in their analysis. For the above reasons, we rated the certainty of the evidence as low or very low for the comparisons and outcomes reported for these studies.

Overall, we found no indication of publication bias, and many of the included studies reported uncertain results.

Potential biases in the review process

The subject of this review was very broad, including all professional interventions on the management of musculoskeletal conditions targeting GPs/family doctors. Although we made every effort to create a broad search strategy that would identify all relevant studies, it is possible that we failed to locate important studies.

We used risk difference for dichotomous outcomes, because, according to Higgins 2011a, paragraph 9.4.4.4, this summary statistic is thought to be easier for clinicians to interpret. However, this measure does not account for differences in baseline compliance between intervention and control groups, and could produce biased effect estimates. We attempted to limit this risk by also calculating the adjusted risk difference (which does take into account baseline differences between groups) wherever the data allowed.

The majority of the included studies were published before 2008. As more studies are being conducted in this increasingly important area, the review will need to be updated in order to identify and incorporate the newest evidence.

Agreements and disagreements with other studies or reviews

The findings of this review in the context of musculoskeletal conditions are largely consistent with what was observed in a comprehensive systematic review (Grimshaw 2004) which reviewed all guideline implementation strategies across all health conditions. It showed GP reminders to have moderate effects. We also found that a GP-alerting system (via a patient-specific letter or electronic reminder), with or without a patient-directed intervention, leads to improved professional behaviour (both diagnosis and treatment) of osteoporosis. This is also in agreement with a more recent systematic review (French 2010). However, unlike Grimshaw 2004, we found that distribution of educational material on its own may result in no or minimal improvement, with only a small 5% RD in the study by Rahme 2005 and no significant improvement in the study by Hollingworth 2002.

A Cochrane systematic review by Giguere 2012 which evaluated the effect of printed educational materials concluded that this intervention, when used alone, may have a small beneficial effect on GP behaviour and process-related outcomes but not necessarily on patient outcomes. Our review suggests that educational materials alone may not even improve process-related outcomes and guideline-concordant behaviour for low back pain, although our conclusion is based on only one study with ITS design (Hollingworth 2002).

We are unable to comment on the effect of feedback on performance when used on its own, as this was only used as part of a multifaceted intervention in the included studies. A systematic review by Bywood 2008 showed that feedback is an effective strategy which can facilitate professional behaviour change, and a more recent Cochrane review (Ivers 2012) confirmed this finding.

The use of local opinion leaders was evaluated as part of a multifaceted intervention in three studies (Majumdar 2008; Schectman 2003; Stross 1985), two of which (Majumdar 2008; Stross 1985) showed that it probably results in improved GP behaviour. This is in accordance with the Cochrane review (Flodgren 2011) which concluded that the use of local opinion leaders can successfully promote evidence-based practice but that effectiveness varied both within and between studies.

Guidelines and educational reminder messages attached to radiology reports (Eccles 2001) may result in small but sustained reductions in GP radiology requests. This is in accordance with the findings by French 2010.

The use of educational meetings and workshops showed varied results in our review. It seemed to work better for improving GP behaviour in the management of osteoarthritis (Chassany 2006; Rahme 2005; Rosemann 2007; Stross 1985) and not so well when trying to improve the management of low back pain (Bishop 2006; Dey 2004; Engers 2005; French 2013; Hazard 1997; Schectman 2003). A systematic review (Smith 2009) concluded that educational meetings alone, or as a component of multifaceted interventions, can result in small to moderate increases in the adoption of desired behaviours by healthcare professionals. Also, meetings that combined interactive and didactic approaches seemed to be more effective in changing the behaviour of healthcare professionals than meetings that were purely didactic or interactive. The meetings and workshops in the studies included in our review had both an interactive and a didactic component.

Our review investigated whether it is more challenging trying to effect a reduction in established clinician behaviours than to generate new routines, as suggested by French 2010. Although an initial analysis of the effects of studies depending on the direction of behavioural change seemed to agree with this notion, this observation may have been a consequence of the management specifics of the conditions in the included studies, as demonstrated by the results of the subgroup analysis which included only studies on the same conditions. We could not find any systematic review that looked in detail into this issue. Behaviour change is a complex process and interventions are commonly designed without evidence of having gone through a process of analysing the target behaviour or the theoretically-predicted mechanisms of action as advocated by Michie 2011. The theoretical framework behind the design of the interventions in the studies included here was not always apparent. Lally 2010 showed that repeating a behaviour in response to a cue appeared to be enough for many people to develop automaticity for that behaviour. It is not clear how applicable this observation is when trying to develop new clinical habits. Additionally, there seems to be a lack of evidence surrounding the complexities of stopping an established clinical behaviour.

AUTHORS' CONCLUSIONS

Implications for practice

This review identified thirty studies that evaluated a variety of professional interventions intended to improve the management of musculoskeletal conditions by GPs. The most effective intervention in terms of improving GP behaviour seems to be the use of GP alerting on a patient's increased risk of osteoporosis, and patient education and reminders to see their GP for their management. Just alerting the GP also probably leads to improved clinician behaviour, and this intervention is relatively easy to implement. The combination of guidelines and GP reminder messages attached to radiology reports may result in a small but sustained reduction in the number of radiology requests, which is another relatively simple intervention to put into practice.

Implications for research

Future research is needed to identify professional interventions which are successful at improving the management of musculoskeletal conditions. Although GP alerting and patient education seemed to increase concordance with osteoporosis guidelines, it is unclear whether these methods would result in improved patient related outcomes and whether they would be equally effective for improving the management of other musculoskeletal pathology.

Multifaceted interventions were commonly used; however, it is unclear what would be the most effective combination of component interventions. Additionally, as the costs of an intervention are likely to increase with the number of its components, a cost-effectiveness analysis would add valuable information.

There were no studies evaluating the effectiveness of local consensus processes. With the increasing focus on the importance of local service integration and the development of local clinical pathways of care, there is a need and an opportunity to evaluate the effect of such local processes.

Given that the aim of the interventions is to change clinician behaviour, it would be important that new studies consider and clearly articulate the theoretical framework used when designing new interventions. This information will help the categorisation of interventions and the development of a more efficient method of choosing the kinds of intervention that are likely to be appropriate for a specific behavioural target in a particular context and a defined population.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Becker 2008

Methods	Study Design: Cluster-RCT
Participants	Setting: Primary care Country: Germany. Participants: All 883 family physicians in 2 German regions were invited to participate 118 practices (126 GPs) agreed to participate and were randomised at practice level. 1 practice withdrew and 1 was excluded because it did not recruit any participants. Total participants recruited: 1378 Condition: Low back pain Inclusion criteria for patients were LBP as presenting symptom on the day of recruitment, written consent to participate in the study, and age above 19 years. Exclusion criteria were insufficient German language skills, pregnancy, and isolated thoracic pain
Interventions	Practices were randomised into 2 intervention and 1 "control" group 1. Intervention: Distribution of guidelines on low back pain, 3 interactive seminars, 2 individual academic-detailing sessions, patient leaflets (educational material + outreach visits +educational meetings) 2. Intervention: Distribution of guidelines on low back pain, 3 interactive seminars, 2 individual academic-detailing sessions, patient leaflets. Also, motivational counselling session for GPs and 20-hour training for 2 nurses per practice. Patients recruited received 3 counselling sessions by the nurses (patient-directed component) 3."Control": Distribution of guidelines on low back pain (educational material)
Outcomes	GP outcomes: None Patient outcomes: Functional capacity (measured by Hannover Functional Ability Questionnaire), days in pain, days of sick leave physical activity, quality of life (measured with EuroQol), and Fear Avoidance Beliefs questionnaire
Notes	We were unable to confirm the results and calculate the standardised mean differences (SMD) due to non-reported standard deviations Sources of funding: The study was funded by the German Ministry for Education and Research (BMBF, FKZ 01 EM 0113) Conflicts of interest as declared by the authors: Federal funds were received in support of this work. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Practices were assigned to the 3 study arms by central permuted block randomisation with allocation concealment."

Becker 2008 (*Continued*)

Allocation concealment (selection bias)	Low risk	"Practices were assigned to the 3 study arms by central permuted block randomisation with allocation concealment."
Protection against contamination	Unclear risk	Allocation was by practice but it is unclear if communication between intervention and control practices could have occurred
Baseline outcomes similar	Low risk	No important differences present across study groups.
Baseline characteristics similar	Low risk	Baseline characteristics were reported and were similar between the 2 groups
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"Outcome measure was objective and recorded by interviewers and trained nurses."
Incomplete outcome data (attrition bias) All outcomes	Low risk	All outcomes were reported
Selective reporting (reporting bias)	Unclear risk	No study protocol was published in order to be able to verify this
Other bias	Unclear risk	Possibility of bias during participant recruitment but GPs were asked to recruit consecutive patients

Bessette 2011

Methods	Study design: RCT
Participants	Country: Canada (Quebec) Condition: osteoporosis Participants: 1314 women without osteoporosis treatment were randomised *Inclusion Criteria:* Women, aged 50 years and over Not residing in a long-term care hospital before the fracture Able to understand the programme information and consent form Must voluntarily accept to participate in this programme and sign the consent form Participants must have a fragility or traumatic fracture of one of the following sites: wrist, forearm, humerus, scapula, clavicle, sternum, thoracic or lumbar vertebrae, pelvis, sacrum, hip, femur, proximal and distal tibia, fibula (including ankle), and foot Participants must be able to answer the questionnaires via phone interviews *Exclusion Criteria:* Unable to understand the purpose of the programme Participants with a traumatic fracture of one of the following sites: cervical, skull and face, hand and finger, toe, metatarsus, and patella Pathological fracture Women currently participating in a clinical trial requiring them to take a medication for

	osteoporosis
Interventions	Experimental group 1: Written educational material on osteoporosis for the physician (distribution of educational material) plus education of patients with advice to see their GP and give them written material (patient-directed component) Experimental group 2: 15-minute educational video on osteoporosis as well as written documentation on osteoporosis for the physician (distribution of educational material) plus education of participants with written material and video and advice to see their GP and give them written material (patient-directed component) Control group: No intervention. However the control group completed a questionnaire on osteoporosis which may have increased their awareness
Outcomes	Treatment for osteoporosis (using bisphonates, raloxifene, nasal calcitonin or teriparatide)
Notes	The analysis of the delivery of the reading material to physicians was completed as post hoc observation Conflicts of interest and funding sources as declared by the authors: Conflicts of interest Dr. Bessette has received research grants from Abbott, Amgen, Bristol-Myers-Squibb, Eli Lilly, Merck, Pfizer, and Roche, has received consulting fees or other remuneration from Abbott, Amgen, Merck, Novartis, Pfizer, and Roche and has participated on the speakers bureau for Amgen, Novartis, Merck, Pfizer, Roche, andWarner Chilcott. Dr. Brown has received research grants from Abbott, Amgen, Bristol-Myers-Squibb, Eli Lilly, Pfizer, and Roche, has received consulting fees or other remuneration from Abbott, Amgen, Eli Lilly, Novartis, Merck, and Warner Chilcott and has participated on the speakers bureau for Eli Lilly, Amgen, Novartis, Merck, and Warner Chilcott. Dr. Davison has received consulting fees or other remuneration from Amgen and Servier and has participated on the Speakers' Bureau for Amgen, Merck Frosst Warner Chilcott and Servier. Dr. Ste-Marie has received research grants from the Alliance for Better Bone Health and Novartis, has received consulting fees or other remuneration fromtheAlliance for Better Bone Health,Amgen,Novartis, Eli Lilly, and Servier and has participated on the Speakers' Bureau for the Alliance for Better Bone Health, Amgen, Novartis, Eli Lilly, Servier, and Merck. No other authors have a conflict or interest to disclose The ROCQ program was funded by Merck Frosst Canada, Inc., Warner Chilcott, Sanofi-Aventis group, Amgen Canada Inc., Eli Lilly Canada, Inc., and Novartis Pharmaceuticals Canada, Inc. None of the funding sources had a role in the collection, analysis, or interpretation of the data or in the decision to publish this article.

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	The manner of randomisation has not been reported

Bessette 2011 (*Continued*)

Allocation concealment (selection bias)	Unclear risk	Not reported
Protection against contamination	Low risk	There were 4452 physicians available to treat 1174 included patients and we therefore felt the risk of contamination to be small
Baseline outcomes similar	Low risk	There were no statistically significant baseline differences among the groups for any investigated variable
Baseline characteristics similar	Low risk	The distribution of baseline characteristics was similar among the groups
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	There was no reported blinding of outcome assessment
Incomplete outcome data (attrition bias) All outcomes	High risk	The main outcomes (treatment rates) were reported as percentages. The analysis of the delivery of the reading material to physicians was completed as post hoc observation
Selective reporting (reporting bias)	Low risk	The main outcomes were treatment rates. The protocol of the study was published
Other bias	Unclear risk	The analysis of the delivery of the reading material to physicians was completed as post hoc observation

Bishop 2006

Methods	Study design: RCT
Participants	Setting: Primary care Country: Canada 462 providers, 428 patients Condition: Acute low back pain. Inclusion criteria: The patients included in this study were all residents of British Columbia, Canada, aged between 19 and 65 years. They had as their chief complaint, acute low back pain and an accepted claim with the Workers' Compensation Board of British Columbia relating to an injury that was thought to be causative. All patients included in the study satisfied the Quebec Task Force Classification of Spinal Disorders criteria for categories 1 or 2 and had symptoms for more than 2 weeks and less than 4 weeks.
Interventions	1.Distribution of educational materials to GP only + 3 reminders at 0 - 4 weeks (via letters), 5 - 12 weeks and after 12 weeks 2.Distribution of educational materials to participant and GP + 3 reminders (both to participant and GP) at 0 - 4 weeks, 5 - 12 weeks and after 12 weeks (distribution of

Bishop 2006 (*Continued*)

	educational material, reminders and patient-directed component) 3. Control: no educational material, usual care
Outcomes	GP outcomes: Concordance with specific clinical guideline-derived history-taking items, physical examination procedures and treatment recommendations Patient outcome: None Conflicts of interest and sources of funding as declared by the authors: FDA device/drug status: not applicable. This research was supported by the Workers' Compensation Board of British Columbia, Canada. No funds were received from a commercial entity related to this manuscript.
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Random number generator" used
Allocation concealment (selection bias)	High risk	In group 2 GPs received " a letter from a study physician regarding a specific named patient. "
Protection against contamination	High risk	Randomisation happened at participant level and it is not clear if the same physician was part of both the intervention and the control group Also, there is a risk of contamination if communication occurred between physicians allocated in different groups who worked in the same practice
Baseline outcomes similar	Unclear risk	Not specified
Baseline characteristics similar	Unclear risk	Not specified
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing outcome data
Selective reporting (reporting bias)	Unclear risk	No study protocol published and therefore this could not be verified
Other bias	Unclear risk	It is unclear if either participants or GPs were blinded (possibility of performance bias)

Boyd 2002

Methods	Study design: Randomised trial, no control
Participants	Setting: Primary care Country: USA 149 GPs were sent letters, 258 patients were recruited, 200 patients were contacted by GPs Condition: osteoporosis detected by heel ultrasound Fifty-nine men (mean age 62.8) and 199 women (mean age 58.7) were involved in the survey; thirty-seven men and 163 women were able to be questioned Of Caucasian patients 169 of 223 were reached and of African American patients 30 of 35 were reached
Interventions	1. Patient-mediated: extended letter to physician about patient's risk of osteoporosis after USS screening result including advice on management (educational material) 2. Patient-mediated: short letter about patient's risk of osteoporosis
Outcomes	Number of participants contacted by GPs following distribution of reminders Ordering BMD scan within 6 months Prescription of osteoporosis medication
Notes	There was no control group Conflicts of interest and sources of funding as declared by the authors: Merck, Procter and Gamble, and Aventis pharmaceuticals for unrestricted grants for purchase of supplies and to support student activities related to the health fairs

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Randomly assigned" is the only information provided
Allocation concealment (selection bias)	Unclear risk	Not reported
Protection against contamination	Unclear risk	Randomisation happened at physician level but it is not clear if physicians within the same practice were allocated in different groups
Baseline outcomes similar	Unclear risk	Not specified
Baseline characteristics similar	Unclear risk	Not specified
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported

Boyd 2002 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	High risk	Outcomes for only 63% of participants followed up
Selective reporting (reporting bias)	Unclear risk	No published protocol and therefore unable to verify this
Other bias	Unclear risk	Potential bias when recruiting participants: 149 GPs were sent letters, 258 patients were recruited, 200 patients were contacted by GPs Also, not clear if participants were blinded or if they were aware that they were taking part in the study (potential performance bias)

Broadhurst 2007

Methods	Study design: CBA 2 intervention and 2 control sites (2 divisions of general practice in Adelaide)
Participants	Setting: Primary care Country: Australia 87 GPs were recruited in the intervention group. 90 in the control group. GPs were eligible to participate if they were members in one of these Divisions and were working $\geq$ 0.5 full time equivalent (FTE). All GPs in the two Divisions who met the selection criteria were invited to participate. Condition: Shoulder pain
Interventions	1. Two sessions of academic detailing (outreach session) on shoulder assessment + educational material (DVD) + guideline + follow-up session 3 months afterwards (distribution of educational material) 2. Control group: 90 randomly-selected GPs who received no extra training
Outcomes	GP outcomes: Knowledge score before, immediately after and 3 months after academic detailing + requests for ultrasound and Xray imaging
Notes	Conflicts of interest and funding resources as declared by the authors: Funded by the Diagnostic Imaging Reform Implementation Package, Diagnostic Imaging Section, the Australian Department of Health and Ageing

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Not a randomised study

Broadhurst 2007 (*Continued*)

Allocation concealment (selection bias)	High risk	Not done
Protection against contamination	Unclear risk	There is a possibility of contamination if communication occurred between physicians allocated in different groups but working in the same practice
Baseline outcomes similar	Unclear risk	Not specified
Baseline characteristics similar	Low risk	Baseline characteristics of the intervention and control providers are reported as similar
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	All outcomes reported
Selective reporting (reporting bias)	Unclear risk	No study protocol published and therefore unable to verify this
Other bias	High risk	Possible recruitment (self selection) bias of participants

Chassany 2006

Methods	Study design: RCT
Participants	Setting: Primary care Country: France 180 GPs, randomisation at GP level. 842 patient participants were recruited by the GPs. Patients over 49 years of age could enter the study if they had radiographic confirmation of OA of the knee or hip for at least 6 months, had pain intensity on motion > or equal to 40 mm on a 100 mm visual analogue scale (VAS) the day before inclusion ; and were suitable for treatment with acetaminophen. Condition: Osteoarthritis pain management
Interventions	1. Course on chronic pain management (3 x 4-hourly group sessions), 8 postal letters emphasising recommendations, patient leaflet with 5 statements about pain relief (educational meeting/workshop plus distribution of educational material) 2. Control, unrelated presentation received
Outcomes	Outcomes: Change in the intensity of pain on motion as measure on a 100 mm VAS + Lequesne index score + Womac scores + Global perception of change + Acetaminophen use

Chassany 2006 (*Continued*)

Notes	Conflicts of interest ad sources of funding as declared by the authors: Supported and sponsored by Sanofi-Aventis OTC, Direction Medicale, Gentilly, France

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Randomization stratified according to practice location and date of qualification."
Allocation concealment (selection bias)	High risk	Not done
Protection against contamination	Unclear risk	There is a possibility of contamination if communication occurred between GPs allocated to different groups but working in the same practice
Baseline outcomes similar	Low risk	No important differences present across study groups
Baseline characteristics similar	Low risk	Baseline characteristics are reported as similar
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	Missing data balanced in numbers across groups. Similar reasons for missing data across groups
Selective reporting (reporting bias)	Unclear risk	No evidence of published protocol
Other bias	Unclear risk	Possibility of bias during recruitment of patients by GPs. Unclear if participants were blinded

Ciaschini 2010

Methods	Study design: RCT
Participants	Country: Canada, Ontario Participants: patients over the age of 55, able to give consent and identified to be at risk of future fracture Patients were eligible for inclusion in the study if they were community-dwelling, aged 55 years or older, able to give informed consent, and were identified to be at risk for future fracture according to one of the following criteria: 1. attended the hospital Fracture Clinic for a non-pathological fracture of the vertebrae, hip or wrist or had a BMD in the past year with a T-score of $\leq$-2.0

	2. attended the hospital Emergency Department with a fall and found to be at high risk for falls as defined by a Timed Up and Go [25] result of greater than 14 seconds; or, 3. were self-referred or referred by a health care provider because of perceived high risk of fracture and identified as a high risk for falls defined by a Timed Up and Go result of greater than 14 seconds. Patients already receiving appropriate pharmacological therapy for osteoporosis as outlined in the Osteoporosis Canada guidelines were excluded from the study.
Interventions	Intervention group: The results of the patient's recent BMD test (patient-mediated) and patient-specific advice on prescribing according to the Osteoporosis Canada guidelines (reminders and educational material) were sent to the participant's physician. The participant received personalised counselling on osteoporosis from a research nurse, a written summary of the proposed management plan and educational material (patient-directed component) Control group: usual care
Outcomes	The main outcome was prescribing of osteoporosis medication (alendronate, risedronate, raloxifene) 6 months after the intervention
Notes	The control participants received the intervention 6 months after randomisation (delayed protocol group) Conflicts of interest and sources of funding as declared by the authors: Financial support for completion of the study was given by Merck Frosst Canada Ltd., Sanofi-Aventis Pharma Inc., Proctor & Gamble Pharmaceuticals Canada Inc., Eli Lilly Canada Inc., and the Greenshield Foundation. Equipment (e.g. office space, computers, telephones) was contributed in kind by the Group Health Centre, Algoma Public Health, Sault Area Hospital, Algoma Community Care Access Centre, and the Slips, Trips and Falls Committee of Sault Ste. Marie Safe Communities Partnership, all located in Sault Ste. Marie, Ontario. The Ontario Ministry of Health and Long-term Care provided additional support. PMC is supported by the Algoma District Medical Group in Sault Ste. Marie, Ontario. SES was supported by a salary award from the Alberta Heritage Foundation for Medical Research (Health Scholar) when this study was completed and holds a Canada Research Chair in Knowledge Translation and Quality of Care. LRD is supported by a Canadian Institutes of Health Research Rx&D Health Research Foundation Research Career Award. SRM is supported by salary awards from the Alberta Heritage Foundation for Medical Research (Health Scholar) and the Canadian Institutes for Health Research (New Investigator).

Risk of bias			***Risk of bias***
Bias	**Authors' judgement**	**Support for judgement**	

Ciaschini 2010 (*Continued*)

Random sequence generation (selection bias)	Low risk	A computer-generated randomisation scheme was used
Allocation concealment (selection bias)	High risk	Participants and treating physicians were not blinded
Protection against contamination	Unclear risk	Not reported
Baseline outcomes similar	Low risk	No statistically significant baseline differences were detected among the groups
Baseline characteristics similar	Low risk	Baseline characteristics were similar among the groups
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessors could not be blinded; however the primary source of data was obtained from the Group Health Centre Electronic Medical record
Incomplete outcome data (attrition bias) All outcomes	Low risk	
Selective reporting (reporting bias)	Low risk	All outcomes were reported. The protocol of the study was published
Other bias	Low risk	No other bias identified

Cranney 2008

Methods	Study design: Cluster-RCT 56 cluster practices were in the intervention group and 63 in the control group
Participants	Setting: Primary care Country: Canada 119 GP practices (these were randomised), 270 patients (the unit of analysis) Condition: Osteoporosis Participants patients inclusion criteria: Participants included postmenopausal women who had sustained a wrist fracture (confirmed by x-ray). Women currently taking osteoporosis therapies (e.g., risedronate, raloxifene, alendronate, teriparatide) were excluded, but we did not exclude women on hormone therapy (HT), since they may have been taking HT for menopausal symptoms. Women who had a traumatic wrist fracture (based on description of fracture), or were unable to communicate in English or give consent were also excluded. Women who had a previous BMD test were not excluded, since a previous test could be a predictor of receiving osteoporosis therapy
Interventions	1. Personalised letter to GP from research co-ordinator 2 weeks and 2 months post-fracture (patient-mediated and reminders) incorporating advice on management, recommended therapies and a treatment algorithm (distribution of educational material).

Cranney 2008 (*Continued*)

	Participants also received a letter 2 weeks and 2 months post-fracture with advice to see their GP and an educational booklet (patient-directed component) 2. Control: no information, usual care
Outcomes	Outcomes: Proportion of women who stated that their primary care physician had: Discussed osteoporosis with them + started them on osteoporosis therapy within 6 months of fracture + BMD testing within 6 months + changes in the participant's knowledge of osteoporosis using the Osteoporosis Knowledge Questionnaire (OPQ). Outcomes were assessed by telephone interviews
Notes	Conflicts of interest and sources of funding as declared by the authors: This trial was funded by a peer-reviewed grant from the Canadian Institutes of Health Research (KTS 62358). The study did not provide sufficient information to allow the re-calculation of adjusted for clustering effect sizes

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Computer generated list of random numbers in a blinded fashion"
Allocation concealment (selection bias)	Low risk	As above
Protection against contamination	Unclear risk	Although the practices were randomised using a cluster design, it is still unclear if communication between physicians or patients of different groups was possible
Baseline outcomes similar	Low risk	No important differences present between the groups
Baseline characteristics similar	Low risk	Baseline characteristics were reported as similar
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not clear if telephone interviews were conducted blindly
Incomplete outcome data (attrition bias) All outcomes	Low risk	Similar reasons and rates of dropouts between both groups
Selective reporting (reporting bias)	Unclear risk	No evidence of published protocol
Other bias	Low risk	No other bias identified

Dey 2004

Methods	Study design: cluster-RCT
Participants	Setting: primary care Country: UK 24 practices (practice was the unit of randomisation, stratified by primary care group; 3 primary care groups), 2187 patients Condition: acute LBP Patients were eligible for this study if they were aged between 18 and 64 years, registered with a GP in Birkenhead, Wallasey or West Wirral Primary Care Groups (PCGs), and had consulted their GP about an episode of acute low back pain for which they had not already sought advice during the preceding 6 months
Interventions	1. Educational outreach visit + guidelines (educational material)+ poster of guidelines + referral forms with guidelines + access to fast-track physiotherapy and a back clinic 2. Control: standard practice
Outcomes	Rate of referral for lumbar spine x-ray within 3 months Number of sickness certificates issued Number of prescribed opioids or muscle relaxants Number referred to secondary care Number referred to physio or educational programme
Notes	Conflicts of interest and sources of funding as declared by the authors: None reported

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Random allocation, each centre was given a unique identifier, stratification by primary care group
Allocation concealment (selection bias)	Low risk	Central allocation
Protection against contamination	Unclear risk	Although the practice was the unit of randomisation, it is not clear if communication between practices could affect the results
Baseline outcomes similar	Unclear risk	Not specified
Baseline characteristics similar	Low risk	Baseline characteristics are reported as similar
Blinding of outcome assessment (detection bias) All outcomes	High risk	"Only one research assistant was employed and blind outcome assessment was not possible."
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing outcome data

Dey 2004 (*Continued*)

Selective reporting (reporting bias)	Unclear risk	Insufficient information as no published protocol
Other bias	Low risk	No other bias identified

Eccles 2001

Methods	Study design: cluster-RCT
Participants	Setting: Primary care Country: UK 247 practices randomised; practice was unit of randomisation and analysis-stratified randomisation by radiology department (3 radiology departments) and practice size The audit and feedback intervention was delivered to all eligible GPs according to study design. Condition: acute LBP or knee pain
Interventions	2 x 2 factorial design 1. Distribution of educational materials + audit and feedback (number of practice referrals compared with peers) 2. Distribution of educational materials + reminders (messages on x-ray results) 3. Distribution of educational materials + audit and feedback + reminders 4. Distribution of educational materials (guideline) (control group)
Outcomes	Number of lumbar or knee radiographs requested per 1000 patients for 2 years
Notes	Intervention fidelity: Measured attachment rate of educational reminder messages to x-ray reports Conflicts of interest and sources of funding as reported by the authors: The study was funded by the UK National Health Service Research and Development Primary Secondary Interface Programme. The Health Service Research Unit, University of Aberdeen, is funded by the Chief Scientist Office of the Scottish Office Department of Health. The Centre for Health Services Research, University of Newcastle upon Tyne, and the Health Services Research Unit, University of Aberdeen are members of the Medical Research Council Health Services Research Collaboration

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer-generated random number tables.
Allocation concealment (selection bias)	Low risk	Performed centrally by statistician

Eccles 2001 (*Continued*)

Protection against contamination	Low risk	The intervention was individualised messages and feedback to practices and therefore the risk of it being disseminated to other practices is low
Baseline outcomes similar	High risk	There was baseline imbalance between the groups
Baseline characteristics similar	Unclear risk	Not specified
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcomes were measured objectively by radiology departments
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing outcome data
Selective reporting (reporting bias)	Unclear risk	No published protocol
Other bias	Unclear risk	The intervention of attaching messages to radiology reports was not consistently applied across sites. The site where the messages were attached by an operator pressing a key had an attachment rate of 40% while the other 2 sites had a rate of close to 100%

Engers 2005

Methods	Study design: Cluster-RCT
Participants	Setting: Primary care Country: Netherlands 67 GPs eligible to participate, 41 of these completed outcome reports, 531 participants Condition: Low back pain The participating GPs were asked to recruit consecutive patients with a new episode of low back pain as the main reason for consultation. Low back pain was defined as pain, discomfort, stiffness, or fatigue between the lower edge of the shoulder blades and the gluteal fold either with or without radiation to the legs. Patients who were pregnant, younger than 16 years of age, or not familiar with the Dutch language were excluded. Only patients who were diagnosed with "nonspecific low back pain" and no "red flags" present were included in the analyses
Interventions	1. Two-hour workshop (negotiation skills) , guideline on low back pain and guidance on low back pain for occupational physicians, 2 scientific articles, a patient education tool and a management decision tool (distribution of educational materials) 2. Control: no intervention, usual care

Engers 2005 (*Continued*)

Outcomes	Number of referrals to a therapist (physical, exercise, or manual therapist) Prescription of pain medication on a time-contingent basis Prescription of paracetamol *versus* NSAIDs Adequacy of patient education.
Notes	Conflicts of interest and sources of funding as declared by the authors: The manuscript submitted does not contain information about medical device(s)/drug(s). No funds were received in support of this work. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Computer-generated random- list of numbers" used
Allocation concealment (selection bias)	High risk	"Research team knew which practices received which intervention."
Protection against contamination	Unclear risk	The unit of allocation was the GP so there is a risk of communication between GPs allocated to different groups but working in the same practice
Baseline outcomes similar	Unclear risk	Not specified
Baseline characteristics similar	Unclear risk	Baseline characteristics were reported as similar
Blinding of outcome assessment (detection bias) All outcomes	High risk	"Research team knew which practices received which intervention."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Intention-to-treat analysis performed
Selective reporting (reporting bias)	Unclear risk	No protocol was published (although the protocol is mentioned in the study)
Other bias	High risk	Possible bias as GPs recruited participants. Possible recollection or report bias due to self-reported outcomes

Feldstein 2006

Methods	Study design: RCT
Participants	Setting: Primary care Country: USA 15 practices, 159 providers, 327 participants (randomisation at patient level) Condition: women aged 50 to 89 who had suffered a fracture (any type) and therefore high likelihood of osteoporosis The goal in participant selection was to identify older patients who had fractures indicating an increased risk of osteoporosis, had not received a BMD measurement or a medication for osteoporosis, and did not have medical conditions or other factors that would contraindicate the interventions
Interventions	1. Reminders: electronic medical record message about participant's risk of osteoporosis + distribution of education materials (with guidelines) 2. Reminders + distribution of education materials + patient-directed component (educational material and reminder to see the GP) 3. Control: standard practice
Outcomes	GP outcomes: proportion of study population who received medication for osteoporosis or a BMD test within 6 months after the intervention Participant outcomes: regular physical activity, total caloric expenditure, total calcium intake and patient satisfaction
Notes	Conflicts of interest and sources of funding as declared by the authors: This study was supported by a research contract through Merck & Co. Inc. The funding organization was not involved in the design or conduct of the study; the collection, management, analysis, or interpretation of the data; or in the preparation or approval of this manuscript

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computerised random number generator used
Allocation concealment (selection bias)	Low risk	"The study statistician randomised and assigned participants to the study groups"
Protection against contamination	Unclear risk	Possible contamination as the participant was the unit of randomisation
Baseline outcomes similar	Unclear risk	Not specified
Baseline characteristics similar	Low risk	Baseline characteristics were reported as similar

Feldstein 2006 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Study analyst "was blinded to the treatment groups."
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing outcome data
Selective reporting (reporting bias)	Unclear risk	Protocol mentioned in the study but not published
Other bias	Unclear risk	Unclear if participants were blinded

French 2013

Methods	Study design: Cluster-RCT
Participants	Setting: Primary care Country: Australia 78 practices, 92 GPs were randomised and participated in the study (randomisation at practice level) Condition: Low back pain Patient participant inclusion criteria were people presenting with acute (less than three months duration) non-specific LBP and aged 18 years or older.
Interventions	Intervention group: 2 facilitated, interactive, educational workshops aiming to facilitate behaviour change plus distribution of educational DVDs to all physicians Control group: usual care
Outcomes	Primary outcomes were patient outcomes but due to low numbers of patients recruited, these were not measured Secondary outcomes included self-reported behavioural change and number of x-ray and CT requests
Notes	Not all physicians participated in the full intervention. Only 36 (61%) attended the workshops and an additional 6 watched the DVDs. However the analysis included all physicians Conflicts of interest and sources of funding as declared by the authors: The authors have declared that no competing interests exist. The IMPLEMENT trial was funded by the Australian National Health and Medical Research Council (NHMRC) by way of a Primary Health Care Project Grant (334060). SDF and DAO are supported by NHMRC Early Career Fellowships. RB is supported in part by a NHMRC Practitioner Fellowship. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript

Risk of bias		***Risk of bias***

French 2013 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	An independent and blinded statistician implemented the randomisation (computer-generated random numbers) after stratifying practices based on the number of GPs and whether the practice was rural or not
Allocation concealment (selection bias)	Low risk	Allocation was concealed from the investigators until baseline data had been collected from GPs
Protection against contamination	Low risk	The whole practice was randomised to reduce risk of contamination
Baseline outcomes similar	Unclear risk	There is no information on baseline outcomes (on x-ray and CT numbers)
Baseline characteristics similar	High risk	There was some baseline imbalance, with control GPs more likely to identify themselves as having an interest in low back pain (24% versus 9%) and more GPs in the intervention group undertaking low back pain continuing education in the past year (16% versus 5%)
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Investigators not involved in the intervention who entered the data and the statistician were blinded to group allocation until the statistical analysis was completed
Incomplete outcome data (attrition bias) All outcomes	High risk	The primary outcomes were not measured due to low numbers of participants recruited
Selective reporting (reporting bias)	High risk	As above. Also, subgroup analysis to investigate the effect on GPs who attended the workshop (as per protocol) was not done
Other bias	High risk	Not all physicians participated in the full intervention. Only 36 (61%) attended the workshops and an additional 6 watched the DVDs. However the analysis included all physicians Participants could not be blinded. Primary outcomes not measured. Reported outcomes were self reported

Gormley 2003

Methods	Study design: RCT
Participants	Setting: Primary care Country: Northern Ireland 40 GP principals randomised Condition: Shoulder pain

Gormley 2003 (*Continued*)

Interventions	1. Educational meeting/workshop on shoulder management and injection technique training on mannequins 2. As above plus injection training on real patients
Outcomes	Number of shoulder injections Referrals to physiotherapy and injection clinics over last 6 months Level of confidence (10 cm VAS)
Notes	Conflicts of interest and sources of funding as declared by the authors: None reported

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Not reported in the study
Allocation concealment (selection bias)	Unclear risk	Not reported in the study
Protection against contamination	Low risk	The randomisation was at physician level. The intervention required the physician to be present to practise their skills and therefore contamination is unlikely
Baseline outcomes similar	Low risk	No important differences between the groups
Baseline characteristics similar	Low risk	No important differences between the groups
Blinding of outcome assessment (detection bias) All outcomes	High risk	Not done, this was self reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	"One GP's assessment return after training was incomplete and another failed to make a return. Both of these were in the "mannequin only" training group". It is unclear what the exact proportion of missing data was and if this could bias the results
Selective reporting (reporting bias)	Unclear risk	No published protocol of the study
Other bias	High risk	Results were based on self reporting by GPs. GPs were not blinded

Hazard 1997

Methods	Study design: RCT
Participants	Setting: Primary care Country: USA 59 GPs 59 patients: workers 18-60 years old with VDPQ scores suggesting a high risk of prolonged work disability (i.e. VDPQ score of at least 0.37 (scale = 0-1)) Condition: Low back injury
Interventions	1.Distribution of educational materials + reminders to GPs (letters regarding the specific patient with advice on how to limit work loss) 2. Control
Outcomes	3-month work absence rate VDPQ (disability) score Satisfaction with health care Impact of health care on return to work Days of work loss Days until first return to work
Notes	Conflicts of interest and sources of funding as reported by the authors: Supported, in part, by The National Institute on Disability and Rehabilitation Research, Washington, D.C. (grant H133E30014-95)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Each high risk worker was assigned to the physician intervention group or to the control group, according to a predetermined allotment list developed from a table of random digits balancing the assignments with every six workers"
Allocation concealment (selection bias)	High risk	"Physician was sent a letter identifying the patient and the patient's high risk for work absence 3 months after injury." "The workers themselves knew whether they were in the intervention or control groups"
Protection against contamination	Unclear risk	Physicians could be working in the same practice.
Baseline outcomes similar	Unclear risk	Not specified
Baseline characteristics similar	Unclear risk	Not specified
Blinding of outcome assessment (detection bias) All outcomes	High risk	"The follow up interviewer was not blinded to the VDPQ scores or groups assignments"

Hazard 1997 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing outcome data
Selective reporting (reporting bias)	Unclear risk	No published protocol of the study
Was knowledge of the allocated interventions adequately prevented during the study?	High risk	
Other bias	Unclear risk	Participants were not blinded

Hollingworth 2002

Methods	Study: ITS
Participants	Setting: Primary care Country: UK Number of practices and GPs not reported. Analysed 2100 x-ray referrals The mean age of the 2100 patients whose radiography reports were selected for review was 53.6 years (range = 7 to 94 years), 57.9% were female
Interventions	Distribution of guidelines (by Royal College of General Practitioners and Royal College of Radiologists)
Outcomes	Number of primary care referrals for radiography of the lumbar spine
Notes	Conflicts of interest and sources of funding as declared by the authors: The lead author is sponsored by a MRC training fellowship in Health Services Research. This study was funded in part by task-linked NHS R&D support funding. The work was undertaken at University of Cambridge, which received funding from the NHS Executive eastern region. The views expressed in this publication are those of the authors and not necessarily those of the NHS Executive eastern region

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Was the intervention independent of other changes?	Unclear risk	No other changes were reported at the time of the guideline dissemination. However, such changes (such as waiting times, funding arrangement changes or changes in the prevalence of low back pain were possible)
Was the shape of the intervention effect pre-specified?	Unclear risk	This was not specified in the study

Hollingworth 2002 (*Continued*)

Was the intervention unlikely to affect data collection?	Low risk	The intervention was independent of the data collection method
Was knowledge of the allocated interventions adequately prevented during the study?	Low risk	Participants were not aware of the study
Were incomplete outcome data adequately addressed?	Unclear risk	The study does not give sufficient information on this
Other bias	Low risk	No other risks identified

Huas 2006

Methods	Study design: Cluster-RCT
Participants	Setting: Primary care Country: France 155 GPs (randomisation was stratified by University; 20 different Universities), 772 participants Condition: Chronic musculoskeletal pain All included patients were over 18 years of age, had been suffering for at least 3 months from sustained daily chronic pain, of musculoskeletal origin affecting the locomotor system, and were regularly taking painkillers
Interventions	1.Training in the use of VAS and HAD scales for pain (educational meeting + patient-mediated intervention) 2. Control: usual care
Outcomes	GP outcomes: changes in prescription of painkilling modalities Patient outcomes: Level of relief obtained (numerical relief scale) (self reported by participant)
Notes	Conflicts of interest and sources of funding as declared by the authors: The Fondation de la Caisse Nationale de Prevoyance funded the study and the Nukleus company provided material support

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Randomisation was stratified by University." No further information provided
Allocation concealment (selection bias)	Unclear risk	No information provided

Huas 2006 (*Continued*)

Protection against contamination	Low risk	"In order to avoid contamination bias, physicians from both groups never met during the course of the study"
Baseline outcomes similar	Low risk	"Painkilling treatment prescribed at inclusion was comparable in both groups - the main difference being that a larger number of patients in the scale group were taking level 3 analgesics, although the number of patients concerned was very small"
Baseline characteristics similar	Low risk	"The characteristics of the physicians were comparable for both groups", "The patient groups in the treatment and control groups were of similar nature", "pain location was comparable in the 2 groups except for back pain"
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Participants probably unaware of GPs' training. Not clear how secondary outcomes were assessed and by whom
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	No published protocol of the study
Other bias	Low risk	No other risks identified

Kerry 2000

Methods	Study design: cluster-RCT
Participants	Setting: Primary care Country: UK 69 practices (practice is the level of randomisation), 175 GPs, 43,778 radiological requests Condition: People potentially requiring an x-ray of chest, spine or limbs and joints
Interventions	1. Distribution of guidelines + individual feedback on referral rates + graph of the average radiation dose for different examinations (educational material and audit/feedback) 2. Control: standard care
Outcomes	Professional practice: number of x-rays requested (chest, limbs and joints, spine) within 12 months
Notes	Conflict of interests and sources of funding as declared by the authors: This study was funded by The South Thames Project Grant Scheme.

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**

Kerry 2000 (*Continued*)

Random sequence generation (selection bias)	Low risk	"Practices were randomly allocated to an intervention or a control group using a stratified randomisation."
Allocation concealment (selection bias)	Unclear risk	Not reported
Protection against contamination	Unclear risk	Randomisation was at practice level but unclear if practices of different groups could communicate
Baseline outcomes similar	Unclear risk	Not reported
Baseline characteristics similar	Unclear risk	Not reported. Although randomisation happened using 10 strata depending on "numbers of partners, referral rates, fund-holding status, and having received guidelines in a previous study"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome objectively collected (routine data, collected electronically)
Incomplete outcome data (attrition bias) All outcomes	Low risk	All outcomes were reported
Selective reporting (reporting bias)	High risk	Results (referrals for x-rays) not reported per 1000 patients. Protocol of the study not published
Other bias	Low risk	No other risks identified

Lafata 2007

Methods	Study design: cluster-RCT
Participants	Setting: Primary care Country: USA 15 practices randomised after stratification (randomisation at practice level), 123 primary care physicians, 10,354 patients Condition: women 65 to 89 years of age on 3/31/2003 and high likelihood of osteoporosis with a visit between 4/1/2001 and 3/31/2003 to a primary care physician.
Interventions	1. Patient-directed component (educational material on osteoporosis) 2. Patient-directed (educational material on osteoporosis) + physician prompt/reminder (reminder on electronic medical record and biweekly letter to physician listing patients needing treatment) 3. Control: standard care
Outcomes	Professional practice: proportion of patients receiving BMD testing within 12 months; prescription of osteoporosis medication

Lafata 2007 (*Continued*)

Notes	Possible risk of contamination Conflicts of interest and sources of funding as declared by the authors: Dr. Weiss and Dr. Chen are employees of Merck & Co The study did not provide sufficient information to allow the re-calculation of adjusted for clustering effect sizes

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Within stratum, clinics were allocated to the three arms using a random numbers table"
Allocation concealment (selection bias)	Unclear risk	Not reported
Protection against contamination	Unclear risk	Randomisation was at practice level but unclear if practices of different groups could communicate
Baseline outcomes similar	Low risk	Women with previous BMD screening or on osteoporosis medication were excluded from the evaluation
Baseline characteristics similar	Unclear risk	"Although statistically significant baseline differences were found for most of the patient characteristics assessed, only a handful meaningful differences existed" "Women in the patient mailed reminder arm were less likely to be African American", "there was variation in health plan enrolment". There was no assessment of GP baseline characteristics
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Used "automated clinical and pharmacy data"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Missing outcome data balanced in numbers across intervention groups
Selective reporting (reporting bias)	Unclear risk	Insufficient information provided. No published protocol of the study
Other bias	Low risk	

Leslie 2012

Methods	Study design: RCT
Participants	Setting: Primary care Country: Canada 4264 patients were randomised; patients included men and women 50 years of age and older who had suffered a previous fracture and had not received a BMD or osteoporosis medication Condition: osteoporosis
Interventions	1. Notification letter to primary care physician (reminder) about the patient's fracture accompanied by educational material 2. Notification letter to primary care physician accompanied by educational material as above plus patient-directed intervention (educational material and reminder) 3. Control group: usual care
Outcomes	BMD and osteoporosis medication
Notes	Conflicts of interest and sources of funding as declared by the authors: Wiliam Leslie has received speaker fees from Merck Frosst and Amgen; he has unrestricted research grants from Merck Frosst, Sanofi-Aventis, Procter and Gamble, Novartis, Amgen and Genzyme; he is on the advisory boards for Genzyme, Novartis, and Amgen. Patricia A Caetano has received unrestricted research grant from Amgen. No other competing interests were declared The article was funded by the Manitoba Patient Access Network whose mandate is to identify, advocate, support and guide health system change and process improvement initiatives. The network is financially supported by the Wait Times Reduction Fund and receives secretariat services from Manitoba Health's Wait Times Task Force

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"The randomisation was done using a centralised computer-based algorithm"
Allocation concealment (selection bias)	Low risk	"The computer-based algorithm concealed the allocation process from the clinical investigators"
Protection against contamination	Unclear risk	It is not clear if primary care physicians in the control group were also physicians of patients under the intervention groups
Baseline outcomes similar	Low risk	"The groups were well balanced in terms of age, sex and site of fracture"
Baseline characteristics similar	Low risk	As above. The patients included had not received previous BMD test or osteoporosis medication

Leslie 2012 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	The outcomes were taken from a centralised database
Incomplete outcome data (attrition bias) All outcomes	Low risk	The analysis followed an intention-to-treat methodology and all participants were included
Selective reporting (reporting bias)	Low risk	All outcomes as per study protocol were reported
Other bias	Low risk	No other risks identified

Majumdar 2008

Methods	Study design: RCT
Participants	Setting: Primary care Country: Canada 266 GPs, 272 patients (unit of randomisation the patients) Condition: 50 years or older and distal forearm fracture (high likelihood of osteoporosis) Patients were excluded if they were already receiving treatment for osteoporosis with a bisphosphonate, were unable or unwilling to provide informed consent, had no fixed address, were residing outside the Capital Health region or were residing in a long-term care facility.
Interventions	1. Distribution of guidelines endorsed by five local leaders (educational material) + physician reminder (patient-specific letter to GP) + patient-directed component (education and counselling via telephone) 2. Control group, usual care
Outcomes	Proportion of participants who had received BMD test Prescription of osteoporosis medication Composite measure of quality of guideline-concordant or "appropriate" care *Patient Outcomes:* Health status (SF-12) Osteoporosis-related quality of life Wrist-related functional outcomes Osteoporosis-related knowledge Satisfaction with care Costs: intervention cost per patient (this outcome was reported in a different publication, Majumdar 2007)
Notes	Conflicts of interest and sources of funding as declared by the authors: None declared for Sumit Majumdar, Jeffrey Johnson, Finlay McAlister, Debbie Bellerose, Anthony Russell, Don Morrish, Walter Maksymowych or Brian Rowe. David Hanley has been a clinical investigator in phase III clinical trials of bisphosphonates manufactured by Proctor & Gamble, Merck and Novartis; in addition, he has received speaker fees from and has been a paid consultant on advisory boards of these companies.Sumit Majumdar,

	Jeffrey Johnson, Finlay McAlister and Walter Maksymowych receive salary support awards from the Alberta Heritage Foundation for Medical Research; Sumit Majumdar and Finlay McAlister receive salary support awards from the Canadian Institutes of Health Research; Jeffrey Johnson and Brian Rowe hold Canada Research Chairs; and Finley McAlister holds the Aventis/Merck-Frosst Chair in Patient Health Management. The study was supported by peer-reviewed grants from the Canadian Institutes of Health Research.

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Allocation was concealed by application of various block sizes and by use of a secure,centralised, Internet based computer-generated randomisation system."
Allocation concealment (selection bias)	Low risk	As above
Protection against contamination	High risk	The randomisation unit was the patient and therefore there could be contamination at physician level
Baseline outcomes similar	Unclear risk	Not reported
Baseline characteristics similar	Unclear risk	"Intervention and control patients were comparable" and "all multivariable analysis adjusted" for any differences. There was no assessment of physician characteristics
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"Research nurses collected outcome data without knowledge of allocation status"
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants were accounted for
Selective reporting (reporting bias)	Unclear risk	All outcomes listed in Methods were reported. However, there was no published study protocol
Was knowledge of the allocated interventions adequately prevented during the study?	Low risk	
Other bias	Low risk	"Neither physicians nor patients were aware of the study outcomes"

Rahme 2005

Methods	Study design: Cluster-RCT
Participants	Setting: Primary care Country: Canada 249 providers, patients; before intervention = 3280, and post intervention = 2883 Condition: Osteoarthritis All NSAID, COX-2 inhibitor, or acetaminophen prescriptions dispensed to patients with osteoarthritis were identified. Patients with osteoarthritis were those who had at least one diagnosis for osteoarthritis (ICD-9 code 715) in the previous 1215 days.
Interventions	1. Distribution of educational material (decision-tree laminated sheet) without face-to-face discussion 2. 90-minute workshops on osteoarthritis without distribution of the decision-tree laminated sheet 3. 90-minute workshop on osteoarthritis + distribution of the decision-tree laminated sheet 4. Controls: standard care, no educational intervention
Outcomes	Professional practice: prescription of medications for elderly patients suffering from osteoarthritis
Notes	Conflicts of interest and sources of funding as declared by the authors: Drs. LeLorier, Choquette, Bessette and Rahme have served as consultants and paid speakers for Merck & Co. Inc. and for Pfizer Inc. Ms. Beaulieu is an employee at Merck Frosst Canada Ltd. Dr. Rahme is a research scholar funded by The Arthritis Society.

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Each town was randomly allocated 1 of 4 intervention options". No further details of the randomisation method are given
Allocation concealment (selection bias)	Unclear risk	Not reported
Protection against contamination	Low risk	"The towns were geographically distant to minimise cross-contamination"
Baseline outcomes similar	Unclear risk	Not reported
Baseline characteristics similar	Low risk	"Patient and physician characteristics were on average similar among the four groups"

Rahme 2005 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcomes data were obtained from electronic databases (Provincial Health Care Fund database)
Incomplete outcome data (attrition bias) All outcomes	Low risk	Intention-to-treat analysis performed.
Selective reporting (reporting bias)	Unclear risk	No study protocol was published
Other bias	Unclear risk	Not clear if participants were blinded with regards to the study outcomes

Robling 2002

Methods	Study design: cluster-RCT
Participants	Setting: Primary care Country: UK 30 practices, 182 MRI requests Condition: people who potentially require MRI for knee or lumbar problems
Interventions	1. Distribution of local guidelines + practice-based seminar during which a 15-minute video was shown (outreach visit) 2. Distribution of local guidelines + feedback on practice-specific MRI use and comparative data on orthopaedic and neurosurgical referrals (audit and feedback) 3. (1 + 2) Distribution of educational material plus outreach visits plus audit and feedback 4. Control group: distribution of local guidelines by post
Outcomes	Professional practice: proportion of MRI requests that are in concordance with guideline (length of follow-up not clear) Cost outcome: intervention cost
Notes	Conflicts of interest and sources of funding: The study was funded by the NHS Research and Development Programme on the Primary Secondary Care Interface.

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Randomisation was performed using a random numbers table."
Allocation concealment (selection bias)	Unclear risk	Not reported
Protection against contamination	Unclear risk	Randomisation was at practice level but it is unclear if practices of different groups could communicate

Robling 2002 (*Continued*)

Baseline outcomes similar	Unclear risk	Not reported
Baseline characteristics similar	Unclear risk	Not reported
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"Anonymised interview data were assessed by a study panel" "Panel members were blinded to study randomisation"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	Insufficient information, no study protocol was published.
Other bias	Unclear risk	It is unclear if participants were blinded on the outcome measures

Rosemann 2007

Methods	Study design: Cluster-RCT
Participants	Setting: Primary care Country: Germany 75 practices, 75 GPs, 1021 patients. The GPs were the unit of randomisation Condition: Osteoarthritis To be eligible for inclusion, patients had to be age 18 years and diagnosed with OA in the knee or the hip according to the American College of Rheumatology criteria
Interventions	1. Educational meeting/workshop (2 interactive quality circle meetings of 8 hours each on management of osteoarthritis and motivational skills) plus educational material (written educational material + patient educational material including leaflets, booklets and audio CDs) 2. 1 + practice nurse training to call participants and complete questionnaire on osteoarthritis management 3. Control
Outcomes	*Patient outcomes:* Change in quality of life, assessed by the German version of the Arthritis Impact Measurement Scales Short Form (AIMS2-SF), Health service utilisation Prescriptions Physical activity.
Notes	Conflicts of interest and sources of funding as declared by the authors: None reported

Risk of bias			***Risk of bias***
Bias	**Authors' judgement**	**Support for judgement**	

Rosemann 2007 (*Continued*)

Random sequence generation (selection bias)	Low risk	GPs randomised by SPSS
Allocation concealment (selection bias)	Unclear risk	Not reported
Protection against contamination	High risk	As the randomisation was at GP level, it may have been possible that communication between intervention and control professionals could have occurred
Baseline outcomes similar	Low risk	No significant differences between participant groups were identified
Baseline characteristics similar	Low risk	"No statistically significant differences in the outcome measures" at baseline were found
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Participant answers were cross-checked by a research assistant but it is not clear if the assistants were blinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing outcome data."No practice dropped out during the study"
Selective reporting (reporting bias)	Low risk	Published study protocol
Other bias	Unclear risk	The participants were not blinded and this may have affected the results

Roux 2013

Methods	Study design: RCT
Participants	Setting: Primary care Country: Canada (Quebec, Sherbrooke) Women and men aged 50 years or older with a fracture confirmed on radiograph were screened by the study co-ordinators for circumstances suggestive of a fragility fracture when they attended the orthopedic outpatient clinics Patients unable to speak French or English fluently, as well as those with known severe psychiatric problems, delirium, or dementia were not approached because of their inability to provide valid informed consent. 881 patients were randomised
Interventions	Group 1: Verbal and written information on osteoporosis to patient (patient-directed component) and letter with specific management plan sent to their treating physician (GP reminder). Patient reminders at 6 and 12 months. Reminder to physician if patient untreated at 6 months Group 2: Verbal and written information on osteoporosis to patient (patient-directed component) and letter with specific management plan sent to their treating physician (GP reminder). Blood tests and BMD test ordered for patient and results sent to the physician (patient-mediated intervention). Patient reminders at 4,8 and 12 months and

	physician reminders at 4 and 8 months if patient remained untreated Control group: Telephone interviews at 6 and 12 months to assess treatment scores
Outcomes	Osteoporosis-related drug treatment at 12 months was the main outcome
Notes	Conflicts of interest and sources of funding as reported by the authors: Supported by unrestricted research grants from Merck Canada, The Alliance for Better Bone Health at Procter & Gamble (now Warner Chilcott) and Sanofi-Aventis, Amgen Canada, Novartis Pharmaceuticals Canada Inc., and Servier Canada; and by the Centre de Recherche Clinique Étienne-LeBel (CRC), Centre Hospitalier Universitaire de Sherbrooke (CHUS), which received a team grant from the Fonds de la Recherche en Santé du Québec

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Patients were recruited concurrently by a research co-ordinate from consecutive fracture clinics. Attending surgeons did not play an active role in recruitment Recruitment to the control group was random but not randomised relative to recruitment to the intervention groups in order to avoid contamination between participants
Allocation concealment (selection bias)	Low risk	The consent form outlined all 3 interventions but did not suggest that any of the 3 was more effective. Primary care physicians were blinded to which group their patients were assigned to
Protection against contamination	Unclear risk	Participants were protected from contamination by separating the control and intervention groups but the possibility of physician contamination was not explored
Baseline outcomes similar	Low risk	There were no significant differences between groups
Baseline characteristics similar	High risk	The participants in the first intervention group were older (median age 67 while for the control group this was 64 and for the second intervention group was 63)
Blinding of outcome assessment (detection bias) All outcomes	High risk	The assessors were not blinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	The data were analysed by intention-to-treat methodology
Selective reporting (reporting bias)	Unclear risk	The main outcome was reported but we could not find a published study protocol

Roux 2013 (*Continued*)

Other bias	Unclear risk	Unclear if the participants were blinded

Rozental 2008

Methods	Study design: RT (no control group)
Participants	Setting: Primary care Country: USA Aim 1: 240/298 patients: retrospective review Aim 2: RT 50 patients were randomised to 1 of 2 interventions Condition: Osteoporosis The inclusion criteria included an age of over fifty years (for women) or over sixty-five years (for men), a fragility fracture of the distal part of the radius, no evaluation with a bone mineral density examination within two years before the fracture, and no current treatment with antiresorptive medication or hormone replacement therapy
Interventions	1. Orthopaedic surgeon orders BMD and BMD results are forwarded to primary care physician (patient-mediated) 2. Letter from orthopaedic surgeon to primary care physician outlining guidelines for osteoporosis screening (educational material and reminder) No control group
Outcomes	Professional practice: the rates of evaluation (BMD testing) within 6 months and treatment (discussion and initiation) for osteoporosis
Notes	Conflicts of interest and sources of funding as declared by the authors: In support of their research for or preparation of this work, one or more of the authors received, in any one year, outside funding or grants of less than $10,000 (a Procter and Gamble Development Grant). Neither they nor a member of their immediate families received payments or other benefits or a commitment or agreement to provide such benefits from a commercial entity. No commercial entity paid or directed, or agreed to pay or direct, any benefits to any research fund, foundation, division, center, clinical practice, or other charitable or nonprofit organization with which the authors, or a member of their immediate families, are affiliated or associated

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	No information on how the randomisation took place
Allocation concealment (selection bias)	Unclear risk	No information is provided on allocation concealment

Rozental 2008 (*Continued*)

Protection against contamination	High risk	Randomisation happened at patient level
Baseline outcomes similar	Unclear risk	These were not assessed at baseline
Baseline characteristics similar	Low risk	Baseline characteristics between participant groups seemed similar
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not specified in the paper.Not clear if the assessor was blinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants were accounted for
Selective reporting (reporting bias)	Unclear risk	No study protocol was published
Other bias	Unclear risk	It is unclear if participants were blinded with regards to the outcomes

Schectman 2003

Methods	Study design: Cluster-RCT
Participants	Setting: Primary care Country: USA 85 physicians, 2020 patients, 14 group practice sites, randomisation at practice level Condition: Acute low back pain Patients were eligible for study inclusion if they met all three of the following criteria: (1) presence of low back pain; (2) duration of current symptoms less than 6 weeks; and (3) no episodes of pain reported or office visits for low back pain in the preceding year
Interventions	1. Distribution of guideline on the management of acute low back pain + educational meeting + feedback on back pain encounters + individual follow-up visit by investigator 6 months afterwards and another feedback on back encounters + educational material for patients including a videotape (educational material + meeting + audit + outreach) 2. Education materials for patients: pamphlet and video and 2 reminders within the first 3 months to clinicians to use these materials (educational material) 3. 1 + 2 4. Control group
Outcomes	*Professional practice:* Proportion of lumbar plain x-rays CT or MRI consistent with guideline within 12 months Subspecialty referral Physiotherapy referral *Patient outcomes:* Beliefs about care

Schectman 2003 (*Continued*)

	Satisfaction with care Clinical outcome measures using validated instruments
Notes	Conflicts of interest and sources of funding as reported by the authors: Agency for Health Care Policy and Research, Public Health Service, Department of Health and Human Services, Grant #: RO1 HS07069

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Clinician practices were stratified by affiliation and then, using sealed envelopes, randomised by an investigator to 4 groups in a 2 × 2 factorial design."
Allocation concealment (selection bias)	Low risk	Sealed envelopes used
Protection against contamination	Unclear risk	Randomisation was at practice level and also stratification by affiliation was used which can reduce the risk of contamination. However, there may have been contamination at patient level
Baseline outcomes similar	High risk	"The intervention group had substantially higher utilization of radiologic and specialty services during the baseline period" "Similar baseline differences were found for utilization of services inconsistent with the guideline" "These differences remained, though were diminished, after adjustment for patient characteristics that were strongly associated with utilisation"
Baseline characteristics similar	High risk	Patient and clinician characteristics between the groups were not similar
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported if assessors were blinded
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not recorded if all charts audited
Selective reporting (reporting bias)	Unclear risk	Insufficient information provided; no study protocol was published
Was knowledge of the allocated interventions adequately prevented during the study?	Unclear risk	It is unclear if the participants were blinded with regards to the outcomes

Schectman 2003 (*Continued*)

Other bias	High risk	"The four intervention groups were collapsed into two for analysis and reporting purposes" after the patient education intervention revealed no effect. This was not in accordance with the study protocol. Potential unit of analysis error, potential contamination between groups.

Solomon 2007a

Methods	Study design: cluster-RCT
Participants	Setting: Primary care Country: USA 828 providers, 13,455 patients Condition: people with high likelihood of osteoporosis and high risk of future fracture The at-risk patients were women 65 years of age, men and women 65 years of age with a prior fracture, and men and women 65 yr of age who used oral glucocorticoids.
Interventions	1. Physician education by trained pharmacists or nurses (academic-detailing approach via outreach visits) + educational material and handouts for patients 2. Patient-directed component: 3 mailed letters with educational material and questions to ask the physician 3. 1 + 2 4. Control: standard care
Outcomes	*Professional practice* (primary outcome): number of patients who began osteoporosis medication or had BMD test within 12 months *Patient outcomes* (secondary outcomes): fracture of wrist, humerus or hip
Notes	Conflicts of interest and sources of funding: Dr Solomon possessed research grants in the past from Merck and Proctor & Gamble. Dr Gauthier is an employee of the Arthritis Foundation, which partially funded this study. All other authors state that they have no conflicts of interest.This study was supported by NIH Grant AR48616 and the Arthritis Foundation. The study did not provide sufficient information to allow the re-calculation of adjusted for clustering effect sizes

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Random-number generator. The randomisation was at doctor level
Allocation concealment (selection bias)	Unclear risk	Not reported

Solomon 2007a (*Continued*)

Protection against contamination	Low risk	"All patients in a given physician's practice were randomised as a group (cluster randomisation) to avoid contamination within a given physician's practice"
Baseline outcomes similar	Unclear risk	Not reported
Baseline characteristics similar	Low risk	The baseline characteristics of patients and physicians were similar across the groups
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Data used were electronic from outside sources (from Medicare, PACE, inpatient and outpatient coding)
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing outcome data; intention-to-treat analysis
Selective reporting (reporting bias)	Low risk	Primary and secondary outcomes reported. There is published study protocol
Other bias	Unclear risk	Unclear if the participants were blinded

Stross 1985

Methods	Study: Cluster-RCT
Participants	Setting: Primary care Country: USA Participants: 6 communities in the state of Michigan: 3 were randomly selected to be controls and 3 were designated as intervention communities. 6 educationally influential physicians (EIs) recruited (1 in each community)
Interventions	1. Local opinion leaders' education: self-study programme including textbook, audiovisual materials and recent articles on osteoarthritis (distribution of educational material and local opinion leaders) The aim was to improve the management of patients with OA by focusing on the role of intra-articular corticosteroids, physical therapy and joint replacement 2. Standard care: no educational package
Outcomes	Total hip arthroplasties, use of intra-articular corticosteroids, use of physical therapy
Notes	Conflicts of interest and sources of funding as declared by the authors: Supported by Multipurpose Arthritis Center grant 2P 60 AM20557 from the National Institute of Arthritis, Diabetes, Digestive and Kidney Diseases

Risk of bias		***Risk of bias***

Stross 1985 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Unclear how the randomisation took place
Allocation concealment (selection bias)	Unclear risk	Not reported
Protection against contamination	Low risk	Contamination is less likely due to the randomisation at large cluster level
Baseline outcomes similar	Low risk	There were no significant baseline differences between the groups
Baseline characteristics similar	Unclear risk	Not reported
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported, although data were obtained from hospital records
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not reported
Selective reporting (reporting bias)	Unclear risk	No published protocol of the study
Other bias	Unclear risk	It is not clear if the participants were blinded with regards to the outcomes

Watson 2008

Methods	Study design: Cluster-RCT
Participants	Setting: Primary care Country: UK 160 providers, 91 practices were randomised to training or not training, 155 patients participated in the first part of the trial Condition: Acute shoulder pain Patients were eligible if: 1. they were presenting to GPs with pain in one or both shoulders for $\leq$12 months who would otherwise have received a steroid injection from primary care. 2. had a clinical diagnosis of rotator cuff tendonitis based on both history of pain in the deltoid area and pain during resisted active movement. Some mild restriction of passive movement was acceptable. 3. were $\geq$ 16 yrs. 4. were able and willing to give informed consent.
Interventions	1. 60-minute lecture on shoulder disorders, handouts, training in injection techniques (educational material + meeting) 2. Control (no educational intervention)

Outcomes	*Patient Outcomes:* Shoulder pain assessed by 4 instruments: score on the British Shoulder Disability Questionnaire (BSDQ), SF-36, EuroQol and three VAS (night, rest, movement)
Notes	The study had a second part testing whether cortisone injections were better than anaesthetic injections for rotator cuff problems (patients were randomised into 2 groups) The study included a cost-effectiveness analysis Conflicts of interest and sources of funding as declared by the authors: V.M. and J.W. received salary from the MRC research grant. J.D. has received travel grants from Pfizer, Wyeth, Novartis and Napp and honoraria for tutorials from Pfizer and Novartis. He has served on advisory boards for pharmaceutical companies including GlaxoSmithKline, Wyeth, Novartis and IDEA. All other authors have declared no conflicts of interest.This trial was funded by the Medical Research Council (grant number G0001147) and received support for the education seminars and training events from Merck, Sharp and Dohme. The MRC established a trial steering committee to advise the grant holders and trial team on trial design, the collection, analysis, interpretation and writing up of data and publication policy

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Computer generated sequence" used. Practices "were stratified by area"
Allocation concealment (selection bias)	High risk	"Patients were not informed of the allocation." But the researchers were not blinded.
Protection against contamination	Unclear risk	Randomisation was at practice level but it is not clear if practices of different groups could communicate between themselves
Baseline outcomes similar	Unclear risk	Not reported
Baseline characteristics similar	Low risk	The participant baseline characteristics were reported and were similar
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported; participants completed the pain-assessment questionnaires
Incomplete outcome data (attrition bias) All outcomes	Low risk	Intention-to-treat analysis was performed
Selective reporting (reporting bias)	Unclear risk	Not enough information is provided. The study protocol has not been published

Other bias	Unclear risk	Unclear if participants were blinded with regards to the outcomes.

CBA: controlled before-and-after
BMD: bone mineral density
HAD: Hamilton anxiety and depression
ITS: interrupted time series
LBP: low back pain
RCT: randomised controlled trial
USS: ultrasound scan
VAS: visual analogue scale
VDPQ: Vermont Disability Prediction Questionnaire

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Ashe 2004	This was a small controlled trial; not all outcomes were reported and the measurement of the main outcome (investigations for osteoporosis) was not well defined and not objectively measured or reported
Corson 2011	This was an organisational intervention and not a professional one according to the EPOC taxonomy
Fabiani 2004	Before-and-after study. 3 groups. There were no 2-intervention and 2-control groups
Feldstein 2007	Retrospective cohort study. No 2-intervention and 2-control groups
Garala 1999	CBA with no 2-intervention and 2-control groups
Gardner 2002	Retrospective cohort study in a hospital setting
Gardner 2005	The intervention was directed at patients and not their physicians
Glazier 2005	GPs not more than 50% of participants
Goldberg 2001	GPs not more than 50% of participants
Ioannidis 2008	Before-and-after study with no controls
Ioannidis 2009	2-year cohort study with no controls
McDonald 2003	Quasi-experimental with no controls
Nazareth 2002	Observational study, no control group

(*Continued*)

Rolfe 2001	Pilot study, irrelevant topic (leg ulcer, persistent wheeze and stable angina)
Ruiz 2001	No objective measurement of primary outcomes
Solomon 2007b	Only 1/3 of participants trained in family medicine
Vernacchio 2013	This was an ITS study addressed to paediatric physicians as opposed to general primary care physicians

CBA: controlled before-and-after

DATA AND ANALYSES

Comparison 1. Meta-analysis of osteoporosis studies evaluating physician and patient interventions versus usual care

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Bone Mineral Density	3	3386	Risk Ratio (M-H, Fixed, 95% CI)	4.44 [3.54, 5.55]
2 Osteoporosis medication	5	4223	Risk Ratio (M-H, Fixed, 95% CI)	1.71 [1.50, 1.94]

Comparison 2. Meta-analysis of osteoporosis studies evaluating physician-only interventions versus usual care

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Bone mineral density	2	3047	Risk Ratio (M-H, Fixed, 95% CI)	4.75 [3.62, 6.24]
2 Osteoporosis medication	2	3047	Risk Ratio (M-H, Fixed, 95% CI)	1.52 [1.26, 1.84]

Comparison 3. Meta-analysis of osteoporosis studies evaluating physician only interventions versus physician and patient interventions

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Bone mineral density	2	2995	Odds Ratio (M-H, Fixed, 95% CI)	0.93 [0.77, 1.12]
2 Medication	2	2995	Risk Ratio (M-H, Fixed, 95% CI)	0.93 [0.79, 1.10]

Analysis 1.1. Comparison 1 Meta-analysis of osteoporosis studies evaluating physician and patient interventions versus usual care, Outcome 1 Bone Mineral Density.

Review: Professional interventions for general practitioners on the management of musculoskeletal conditions

Comparison: 1 Meta-analysis of osteoporosis studies evaluating physician and patient interventions versus usual care

Outcome: 1 Bone Mineral Density

Study or subgroup	Intervention n/N	Usual care n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Feldstein 2006	36/110	2/103		2.5 %	16.85 [4.16, 68.23]
Leslie 2012	258/1421	58/1480		68.4 %	4.63 [3.52, 6.10]
Majumdar 2008	71/137	24/135		29.1 %	2.92 [1.96, 4.34]
Total (95% CI)	**1668**	**1718**		**100.0 %**	**4.44 [3.54, 5.55]**

Total events: 365 (Intervention), 84 (Usual care)

Heterogeneity: Chi^2 = 7.89, df = 2 (P = 0.02); I^2 =75%

Test for overall effect: Z = 13.01 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 1.2. Comparison 1 Meta-analysis of osteoporosis studies evaluating physician and patient interventions versus usual care, Outcome 2 Osteoporosis medication.

Review: Professional interventions for general practitioners on the management of musculoskeletal conditions

Comparison: 1 Meta-analysis of osteoporosis studies evaluating physician and patient interventions versus usual care

Outcome: 2 Osteoporosis medication

Study or subgroup	Intervention n/N	Usual care n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Ciaschini 2010	29/52	16/60		5.2 %	2.09 [1.29, 3.39]
Feldstein 2006	22/110	5/103		1.8 %	4.12 [1.62, 10.47]
Leslie 2012	234/1421	157/1480		53.6 %	1.55 [1.29, 1.87]
Majumdar 2008	30/137	10/135		3.5 %	2.96 [1.51, 5.81]
Roux 2013	307/526	71/199		35.9 %	1.64 [1.34, 2.00]
Total (95% CI)	**2246**	**1977**		**100.0 %**	**1.71 [1.50, 1.94]**
Total events: 622 (Intervention), 259 (Usual care)					
Heterogeneity: Chi^2 = 7.79, df = 4 (P = 0.10); I^2 =49%					
Test for overall effect: Z = 8.10 (P < 0.00001)					
Test for subgroup differences: Not applicable					

Analysis 2.1. Comparison 2 Meta-analysis of osteoporosis studies evaluating physician-only interventions versus usual care, Outcome 1 Bone mineral density.

Review: Professional interventions for general practitioners on the management of musculoskeletal conditions

Comparison: 2 Meta-analysis of osteoporosis studies evaluating physician-only interventions versus usual care

Outcome: 1 Bone mineral density

Study or subgroup	Intervention n/N	Usual care n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Feldstein 2006	40/101	2/103		3.4 %	20.40 [5.06, 82.16]
Leslie 2012	224/1363	58/1480		96.6 %	4.19 [3.17, 5.54]
Total (95% CI)	**1464**	**1583**		**100.0 %**	**4.75 [3.62, 6.24]**
Total events: 264 (Intervention), 60 (Usual care)					
Heterogeneity: Chi^2 = 4.97, df = 1 (P = 0.03); I^2 =80%					
Test for overall effect: Z = 11.23 (P < 0.00001)					
Test for subgroup differences: Not applicable					

Analysis 2.2. Comparison 2 Meta-analysis of osteoporosis studies evaluating physician-only interventions versus usual care, Outcome 2 Osteoporosis medication.

Review: Professional interventions for general practitioners on the management of musculoskeletal conditions

Comparison: 2 Meta-analysis of osteoporosis studies evaluating physician-only interventions versus usual care

Outcome: 2 Osteoporosis medication

Study or subgroup	Intervention n/N	Usual care n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Feldstein 2006	28/101	5/103		3.2 %	5.71 [2.30, 14.20]
Leslie 2012	200/1363	157/1480		96.8 %	1.38 [1.14, 1.68]
Total (95% CI)	**1464**	**1583**		**100.0 %**	**1.52 [1.26, 1.84]**
Total events: 228 (Intervention), 162 (Usual care)					
Heterogeneity: Chi^2 = 9.00, df = 1 (P = 0.003); I^2 =89%					
Test for overall effect: Z = 4.35 (P = 0.000014)					
Test for subgroup differences: Not applicable					

Analysis 3.1. Comparison 3 Meta-analysis of osteoporosis studies evaluating physician only interventions versus physician and patient interventions, Outcome 1 Bone mineral density.

Review: Professional interventions for general practitioners on the management of musculoskeletal conditions

Comparison: 3 Meta-analysis of osteoporosis studies evaluating physician only interventions versus physician and patient interventions

Outcome: 1 Bone mineral density

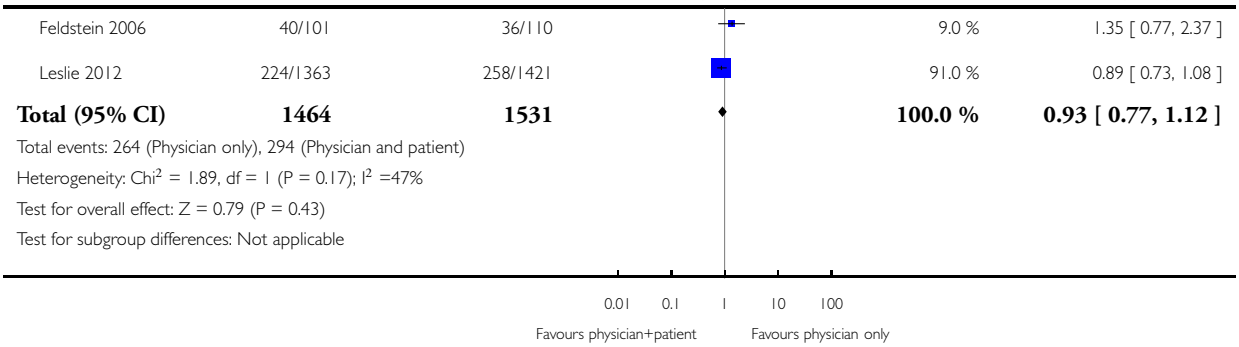
Study or subgroup	Physician only n/N	Physician and patient n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Feldstein 2006	40/101	36/110		9.0 %	1.35 [0.77, 2.37]
Leslie 2012	224/1363	258/1421		91.0 %	0.89 [0.73, 1.08]
Total (95% CI)	**1464**	**1531**		**100.0 %**	**0.93 [0.77, 1.12]**

Total events: 264 (Physician only), 294 (Physician and patient)

Heterogeneity: Chi^2 = 1.89, df = 1 (P = 0.17); I^2 =47%

Test for overall effect: Z = 0.79 (P = 0.43)

Test for subgroup differences: Not applicable

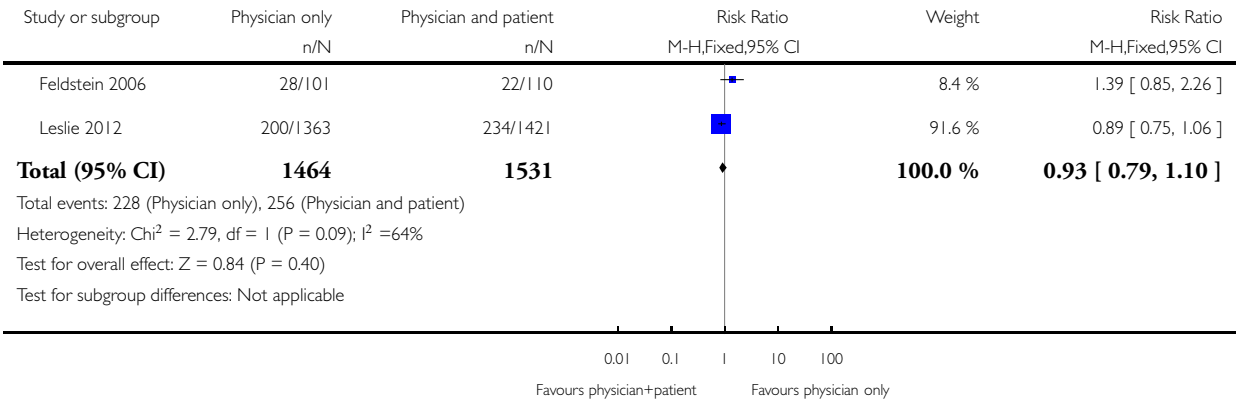


Analysis 3.2. Comparison 3 Meta-analysis of osteoporosis studies evaluating physician only interventions versus physician and patient interventions, Outcome 2 Medication.

Review: Professional interventions for general practitioners on the management of musculoskeletal conditions

Comparison: 3 Meta-analysis of osteoporosis studies evaluating physician only interventions versus physician and patient interventions

Outcome: 2 Medication



ADDITIONAL TABLES

Table 1. Classification of relevant interventions from EPOC taxonomy

Table 1: Classification of relevant interventions from EPOC taxonomy	Table 1: Classif
Intervention	**Description**
Distribution of educational materials	Distribution of published or printed recommendations for clinical care, including clinical practice guidelines, audio-visual materials and electronic publications. The materials may have been delivered personally or through mass mailings
Educational meetings	Healthcare providers who have participated in conferences, lectures, workshops or traineeships
Local consensus processes	Inclusion of participating providers in discussion to ensure that they agreed that the chosen clinical problem was important and the approach to managing the problem was appropriate
Educational outreach visits	Use of a trained person who met with providers in their practice settings to give information with the intent of changing the provider's practice. The information given may have included feedback on the performance of the provider(s)

Table 1. Classification of relevant interventions from EPOC taxonomy (*Continued*)

Local opinion leaders	Use of providers nominated by their colleagues as 'educationally influential'. The investigators must have explicitly stated that their colleagues identified the opinion leaders
Patient-mediated	New clinical information (not previously available) collected directly from patients and given to the provider e.g. depression scores from an instrument
Audit and feedback	Any summary of clinical performance of health care over a specified period of time. The summary may also have included recommendations for clinical action. The information may have been obtained from medical records, computerised databases, or observations from patients
Reminders	Patient or encounter specific information, provided verbally, on paper or on a computer screen, which is designed or intended to prompt a health professional to recall information. This would usually be encountered through their general education; in the medical records or through interactions with peers, and so remind them to perform or avoid some action to aid individual patient care. Computer aided decision support and drugs dosage are included
Marketing	Use of personal interviewing, group discussion ('focus groups') , or a survey of targeted providers to identify barriers to change and subsequent design of an intervention that addresses identified barriers
Mass media	(i) Varied use of communication that reached great numbers of people including television, radio, newspapers, posters, leaflets, and booklets, alone or in conjunction with other interventions; (ii) Targeted at the population level
Other	Patient-directed (education and reminders to see their primary care physician)

Table 2. Intervention types used in each study (N.B. All interventions evaluated were professional)

Table 2. Intervention types used in each study (N.B. All interventions evaluated were professional) **Table 2. Interve**

Intervention methods [1,2]	No. of Studies	Studies [3]
Distribution of educational materials	27	Becker 2008; Bessette 2011; Bishop 2006; Boyd 2002; Broadhurst 2007; Chassany 2006; Ciaschini 2010; Cranney 2008; Dey 2004; Eccles 2001; Engers 2005; Feldstein 2006; French 2013; Hazard 1997; Hollingworth 2002; Kerry 2000; Leslie 2012; Majumdar 2008; Rahme 2005; Robling 2002; Rosemann 2007; Roux 2013; Rozental 2008; Schectman 2003; Solomon 2007a; Stross 1985; Watson 2008

Table 2. Intervention types used in each study (N.B. All interventions evaluated were professional) (*Continued*)

Educational meetings	10	Becker 2008; Chassany 2006; Engers 2005; French 2013; Gormley 2003; Huas 2006; Rahme 2005; Rosemann 2007; Schectman 2003, Watson 2008
Local consensus processes	0	
Educational outreach visits	6	Becker 2008; Broadhurst 2007; Dey 2004; Robling 2002; Schectman 2003; Solomon 2007a
Local opinion leaders	3	Majumdar 2008; Stross 1985; Schectman 2003
Patient-mediated	6	Boyd 2002; Ciaschini 2010; Cranney 2008; Huas 2006; Roux 2013; Rozental 2008
Audit and feedback	4	Eccles 2001; Kerry 2000; Robling 2002; Schectman 2003
Reminders	11	Bishop 2006; Ciaschini 2010; Cranney 2008; Eccles 2001; Feldstein 2006; Hazard 1997; Lafata 2007; Leslie 2012; Majumdar 2008; Roux 2013; Rozental 2008
Marketing	0	
Mass media	0	
Patient-directed[4]	12	Becker 2008; Bessette 2011; Bishop 2006; Leslie 2012; Ciaschini 2010; Cranney 2008; Feldstein 2006; Lafata 2007; Majumdar 2008; Rosemann 2007; Roux 2013; Solomon 2007a

1. Category of intervention as classified by the EPOC taxonomy EPOC 2007 [9]
2. See Table 1 for definition of each intervention
3. Some studies used more than one intervention type and these are listed against their corresponding category
4. Patient-directed interventions targeted patients and included patient education and reminders to see their primary-care physician. These were included in the review only if they were a component of a professional intervention targeting primary-care physicians

Table 3. Intervention combinations compared to a no-intervention control group

Table 3. Intervention combinations compared to a no-intervention control group		
Intervention combinations	**No. of comparisons**	**Study ID**
Single component interventions:		
Distribution of educational materials	1	Rahme 2005
Patient-directed	3	Lafata 2007; Leslie 2012; Solomon 2007a
Educational meetings, workshops	1	Rahme 2005

Table 3. Intervention combinations compared to a no-intervention control group (*Continued*)

Multifaceted interventions: Two intervention components		
Distribution of educational material + reminders	4	Bishop 2006; Feldstein 2006; Hazard 1997; Leslie 2012
Distribution of educational material + educational outreach visits	4	Broadhurst 2007; Chassany 2006; Dey 2004; Solomon 2007a
Distribution of educational material + educational meeting/workshop	6	Chassany 2006; Engers 2005; French 2013; Rahme 2005; Rosemann 2007; Watson 2008
Distribution of educational material + local opinion leaders	1	Stross 1985
Distribution of educational material + audit/feedback	1	Kerry 2000
Patient-mediated + educational meeting/workshop	1	Huas 2006
Patient-directed +reminder	1	Lafata 2007
Patient-directed + educational material	1	Bessette 2011
Multifaceted interventions: Three intervention components		
Patient-directed + educational material + reminder	3	Bishop 2006; Feldstein 2006, Leslie 2012
Patient-directed + educational material + educational meeting/workshop	1	Rosemann 2007
Patient-directed + educational material + educational outreach visit	1	Solomon 2007a
Multifaceted interventions: Four intervention components		
Patient-directed + distribution of educational material + reminder + local opinion leaders	1	Majumdar 2008
Patient-mediated + distribution of educational material + reminders + patient-directed (education and reminders)	3	Ciaschini 2010; Cranney 2008; Roux 2013

Table 3. Intervention combinations compared to a no-intervention control group (*Continued*)

Multifaceted interventions: Five intervention components		
Distribution of educational material + educational meetings/workshops + audit + educational outreach visit + local opinion leaders	1	Schectman 2003

Table 4. Intervention combinations compared to a different intervention

Table 4. Intervention combinations compared to a different intervention **Table 4. Interve**

Intervention combinations	No. of comparisons	Study ID
Single component interventions:		
Educational meetings/workshops vs distribution of educational material	1	Rahme 2005
Educational meetings/workshops vs a different educational meeting/workshop	1	Gormley 2003
Multifaceted interventions: Two intervention components		
Distribution of educational material + patient-mediated vs the same intervention but less intensive	1	Boyd 2002
Distribution of educational material + educational outreach visit vs distribution of educational material	1	Robling 2002
Distribution of educational material + audit vs distribution of educational material	2	Robling 2002; Eccles 2001
Distribution of educational material + audit vs distribution of educational material + reminder	1	Eccles 2001
Distribution of educational material + outreach vs distribution of educational material + audit	1	Robling 2002
Distribution of educational material + educational outreach visit vs patient-directed	1	Solomon 2007a

Table 4. Intervention combinations compared to a different intervention (*Continued*)

Distribution of educational material + patient-directed vs the same (more intensive)	1	Bessette 2011
Patient-directed + reminder vs patient-directed	1	Lafata 2007
Distribution of educational material + reminder vs distribution of educational material	1	Eccles 2001
Distribution of educational material + reminder vs patient-mediated	1	Rozental 2008
Distribution of educational material + educational meeting/workshop vs educational meeting/workshop	1	Rahme 2005
Distribution of educational material + educational meeting/workshop vs distribution of educational material	1	Rahme 2005
Multifaceted interventions: Three intervention components		
Distribution of educational material + reminders + patient-directed vs distribution of educational material + reminders	2	Bishop 2006; Feldstein 2006
Distribution of educational material + reminder + patient-directed vs patient-directed	1	Leslie 2012
Distribution of educational material + audit + reminders vs distribution of educational material	1	Eccles 2001
Distribution of educational material + audit + reminders vs distribution of educational material + audit	1	Eccles 2001
Distribution of educational material + audit + reminders vs distribution of educational material + reminders		Eccles 2001
Distribution of educational material + audit + outreach vs distribution of educational material + outreach	1	Robling 2002

Table 4. Intervention combinations compared to a different intervention (*Continued*)

Distribution of educational material + audit + outreach vs distribution of educational material + audit	1	Robling 2002
Distribution of educational material + audit + outreach vs distribution of educational material	1	Robling 2002
Distribution of educational material + educational meetings/workshops + educational outreach visits vs distribution of educational material	1	Becker 2008
Distribution of educational material + educational outreach visit + patient-directed vs patient-directed	1	Solomon 2007a
Distribution of educational material + educational outreach visit + patient-directed vs distribution of educational material + educational outreach visit	1	Solomon 2007a
Distribution of educational material + educational meeting/workshop + patient-directed vs distribution of educational material + educational meeting/workshop	1	Rosemann 2007
Multifaceted interventions: Four intervention components		
Distribution of educational material + educational meetings/workshops + educational outreach visits + patient-directed vs distribution of educational material	1	Becker 2008
Distribution of educational material + educational meetings/workshops +educational outreach visits + patient directed vs distribution of educational material + educational meetings/workshops + educational outreach visits	1	Becker 2008
Patient-mediated + distribution of education material + reminders + patient-directed (education and reminders) vs patient-mediated + distribution of education material + reminders + patient-di-	1	Roux 2013

Table 4. Intervention combinations compared to a different intervention (*Continued*)

rected (education and reminders)		

Table 5. Osteoporosis studies: intervention versus no intervention (control), outcome: BMD, dichotomous data

(Study) Intervention	Int pre (%) [1]	C pre (%)[2]	Int post (%) [3]	C post (%)[4]	ARD [5]	Risk difference [6] (*P* value if reported)	Relative % change post [7]	Risk ratio [8]
(Bessette 2011)* Patient education and reminder to see their physician (patient directed), education of physician via the patient (distribution of educational material)	-	-	14.72%	11.96%	-	2.8%	23%	1.2
(Bessette 2011)* Patient education (including video on osteoporosis) and reminder to see their physician, education of physician via the patient (distribution of educational material)	-	-	15.81%	11.96%	-	3.9%	32%	1.3

Table 5. Osteoporosis studies: intervention versus no intervention (control), outcome: BMD, dichotomous data (*Continued*)

(Cranney 2008)** Patient-specific mailed letter to primary are physician (including guidelines) and patient education and reminder	-	-	64/125 (51%)	36/145 (25%)	-	26.4% **(P< 0.0001)**	106%	2.1
(Feldstein 2006) Patient-specific Electronic Medical Record (EMR) reminders to primary-care provider informing them of patient increased risk and guidelines. Sent twice	-	-	40/101 (39.6%)	2/103 (1.9%)	-	37.7% **(P< 0.01)**	1940%	20.4
(Feldstein 2006) EMR reminder plus patient-directed intervention: education and reminder	-	-	36/110 (32.7%)	2/103 (1.9%)	-	30.8% **(P< 0.01)**	1585%	16.9
(Lafata 2007)** Patient-directed: 2 mailings (edu-	-	-	720/3367 (21.4%)	313/2901 (10.8%)	-	10.6% **(P< 0.001)**	98%	2

Table 5. Osteoporosis studies: intervention versus no intervention (control), outcome: BMD, dichotomous data (*Continued*)

cational and reminders)								
(Lafata 2007)** Physician prompt: Electronic Medical Record (EMR) reminder to physician and bi-weekly mailing plus patient-directed: 2 mailings (educational and reminders)	-	-	1181/4086 (28.9%)	313/2901 (10.8%)	-	18.1% **(P< 0.001)**	168%	2.7
(Leslie 2012) Physician reminder plus educational material			224/1363 (16.4%)	58/1480 (3.9%)	-	12.5%	319%	4.2
(Leslie 2012) Physician reminder plus educational material plus patient-directed intervention (reminder to see their physician)	-	-	258/1421 (18.2%)	58/1480 (3.9%)	-	14.2%	363%	4.6
(Majumdar 2008) Patient education, physician patient-	-	-	71/137 (51.8%)	24/135 (17.8%)	-	34% **(P< 0.001)**	192%	2.9

Table 5. Osteoporosis studies: intervention versus no intervention (control), outcome: BMD, dichotomous data (*Continued*)

specific reminders by mail/fax, physician guidelines endorsed by opinion leaders								
(Solomon 2007a)** Patient directed (3 mailed letters educational)	-	-	249/3274 (7.6%)	224/3268 (6.9%)	-	0.8% (NS)	11%	1.1
(Solomon 2007a)** Physician education following an academic-detailing approach	-	-	183/3574 (5.1%)	224/3268 (6.9%)	-	-1.7% (NS)	-25%	0.7
(Solomon 2007b)** Combination of both physician and patient education	-	-	223/3339 (6.7%)	224/3268 (6.9%)	-	-0.2% (NS)	-3%	1

1. Intervention group pre-intervention proportion
2. Control group pre-intervention proportion
3. Intervention group post-intervention proportion
4. Control group post-intervention proportion
5. ARD = [Int post (%) minus C post (%)] minus [Int pre (%) minus C pre (%)]. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
6. Risk Difference (RD) is the absolute % change post-intervention = Int post (%) minus C post (%). This is considered to be "small" if ≤ 5%, "modest" if > 5% and ≤10%,"moderate" if > 10% but ≤ 20%, and "large" if > 20%.The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
7. Relative % change post = absolute % change post divided by C post (%). The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
8. Risk ratio (RR) = Int post (%) divided by C post (%)
BMD: bone mineral density; C: control group; Int: intervention group; ARD: adjusted risk difference; NS: not significant

* In the study by Bessette 2011, the outcomes reported above include the participants with a diagnosis following the intervention. The women were considered "diagnosed" if they received a BMD test, if they were informed by their physician that they were suffering from osteoporosis and/or if they were initiated on osteoporosis medication. Therefore, the above percentages do not necessarily mean that the women received a BMD test.
** The data reported above for the studies by Cranney 2008, Lafata 2007 and Solomon 2007b does not account for clustering. We did not have access to sufficient information to adjust the data for clustering.

Table 6. Osteoporosis studies, intervention versus no intervention (control), outcome:osteoporosis medication, dichotomous data

(Study) Intervention	Int pre (%) [1]	C pre (%) [2]	Int post (%) [3]	C post (%) [4]	ARD [5]	Risk difference [6] (*P value if reported*)	Relative % change post [7]	Risk ratio [8]
(Bessette 2011) Patient education (patient directed), education of physician via the patient (for group of patients without diagnosis or treatment at randomisation)	-	-	11.79%	7.78%	-	4%	52%	1.5
(Bessette 2011) Patient education (including video on osteoporosis), education of physician via the patient (for group of patients without diagnosis or treatment at randomisation)	-	-	10.64%	7.78%	-	2.9%	37%	1.4

Table 6. Osteoporosis studies, intervention versus no intervention (control), outcome:osteoporosis medication, dichotomous data (*Continued*)

(Bessette 2011) Patient education (patient directed), education of physician via the patient (for group of patients without treatment at randomisation)	-	-	13.49%	10.31%	-	3.2%	31%	1.3
(Bessette 2011) Patient education (including video on osteoporosis), education of physician via the patient (for group of patients without treatment at randomisation)	-	-	12.71%	10.31%	-	2.4%	23%	1.2
(Bessette 2011) Patient education, education of physician via the patient where the patient did pass the information on to the physician (for group of patients with-	-	-	15%	10%	-	5%	50%	1.5

Table 6. Osteoporosis studies, intervention versus no intervention (control), outcome:osteoporosis medication, dichotomous data (*Continued*)

out treatment at randomisation)								
(Ciaschini 2010) Patient-specific evidence-based recommendations targeted to improve osteoporosis treatment to both the patients and their primary-care providers	-	-	29/52 (55.8%)	16/60 (26.7%)	-	29.1%	109%	2.1
(Cranney 2008)* Patient-specific mailed letter to primary are physician (including guidelines) and patient education and reminder	-	-	35/125 (28%)	15/145 (10.3%)	-	17.7% **(P=0.0002)**	171%	2.7
(Feldstein 2006) Patient-specific Electronic Medical Record (EMR) reminders to primary-care provider informing them of patient in-	-	-	28/101 (27.7%)	5/103 (5%)	-	22.9% **(P< 0.01)**	471%	5.7

Table 6. Osteoporosis studies, intervention versus no intervention (control), outcome:osteoporosis medication, dichotomous data (*Continued*)

creased risk and guidelines. Sent twice								
(Feldstein 2006) EMR reminder plus patient-directed intervention: education and reminder	-	-	22/110 (20.2%)	5/103 (5%)	-	15.1% **(P< 0.01)**	312%	4.1
(Lafata 2007)* Patient-directed: x2 mailings (educational and reminders)	-	-	11/128 (8.6%)	3/51 (5.9%)	-	2.7%	46%	1.5
(Lafata 2007)* Physician prompt: Electronic Medical Record (EMR) reminder to physician and bi-weekly mailing plus Patient-directed: 2 mailings (educational and reminders)	-	-	15/162 (9.3%)	3/51 (5.9%)	-	3.4%	57%	1.6
(Leslie 2012) Physician reminder plus educational material	-	-	200/1363 (14.7%)	157/1480 (10.6%)	-	4.1%	38%	1.4

Table 6. Osteoporosis studies, intervention versus no intervention (control), outcome:osteoporosis medication, dichotomous data (*Continued*)

(Leslie 2012) Physician reminder plus educational material plus patient-directed intervention (reminder to see their physician)	-	-	234/1421 (16.5%)	157/1480 (10.6%)	-	5.9%	55%	1.6
(Majumdar 2008) Patient education, physician patient-specific reminders by mail/fax, physician guidelines endorsed by opinion leaders	-	-	30/137 (21.9%)	10/135 (7.4%)	-	14.5% **(P<0.001)**	196%	3
(Roux 2013) Verbal and written information on osteoporosis to patient and letter with specific management plan sent to their treating physician. Patient reminders at 6 and 12 months.	82/275 (29.8%)	45/199 (22.6%)	151/275 (54.9%)	71/199 (35.7%)	12%	19.2% **(P< 0.005)**	54%	1.5

Table 6. Osteoporosis studies, intervention versus no intervention (control), outcome:osteoporosis medication, dichotomous data (*Continued*)

Reminder to physician if patient untreated at 6 months								
(Roux 2013) Verbal and written information on osteoporosis to patient and letter with specific management plan sent to their treating physician. Blood tests and BMD test ordered for patient and results sent to the physician. Patient reminders at 4,8 and 12 months and physician reminders at 4 and 8 months if patient remained untreated	65/251 (25.9%)	45/199 (22.6%)	156/251 (62.2%)	71/199 (35.7%)	23.2%	26.5% **(P< 0.005)**	74%	1.7
(Solomon 2007a)* Patient directed (x3 mailed letters educational)	-	-	208/3274 (6.4%)	231/3268 (7.1%)	-	-0.7%	-10%	0.9

Table 6. Osteoporosis studies, intervention versus no intervention (control), outcome:osteoporosis medication, dichotomous data (*Continued*)

(Solomon 2007a)* Physician education following an academic detailing approach	-	-	197/3574 (5.5%)	231/3268 (7.1%)	-	-1.6%	-22%	0.8
(Solomon 2007a)* Combination of both physician and patient education	-	-	236/3339 (7.1%)	231/3268 (7.1%)	-	0	0	1

1. Intervention group pre-intervention proportion
2. Control group pre-intervention proportion
3. Intervention group post-intervention proportion
4. Control group post-intervention proportion
5. ARD = [Int post (%) minus C post (%)] minus [Int pre (%) minus C pre (%)]. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
6. Risk Difference (RD) is the absolute % change post-intervention = Int post (%) minus C post (%). This is considered to be "small" if ≤ 5%, "modest" if > 5% and ≤10%,"moderate" if > 10% but ≤ 20%, and "large" if > 20%.The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
7. Relative % change post = absolute % change post divided by C post (%). The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
8. Risk ratio (RR) = Int post (%) divided by C post (%)
BMD: bone mineral density; C: control group; Int: intervention group; ARD: adjusted risk difference; NS: not significant
* The data reported above for the studies by Cranney 2008, Lafata 2007 and Solomon 2007b does not account for clustering. We did not have access to sufficient information to adjust the data for clustering.

Table 7. Osteoporosis studies intervention versus another intervention, outcome: BMD, dichotomous data

(Study) Interventions	Int 1 pre (%) [1]	Int 2 pre (%)[2]	Int 1 post (%)[3]	Int 2 post (%)[4]	ARD [5]	Risk difference[6] (*P value if reported*)	Relative % change post [7]	Risk ratio [8]
(Bessette 2011)* Patient education, education of physician			14.72%	15.81%		-1.1%	-7%	0.9

Table 7. Osteoporosis studies intervention versus another intervention, outcome: BMD, dichotomous data (*Continued*)

via the patient, reminder to family physician **versus** Patient education (including video on osteoporosis), education of physician via the patient, reminder to family physician								
(Boyd 2002) Patient-specific letter to primary care physician containing information on results and recommendations: standard **versus** extended letter	-	-	25/83 (30.1%)	29/78 (37.2%)	-	-7.1%	-19%	0.8
(Feldstein 2007) Patient-specific Electronic Medical Record (EMR) reminders to primary-care provider informing them of patient in-	-	-	40/101 (39.6%)	36/110 (32.7%)	-	6.9%	21%	1.2

Table 7. Osteoporosis studies intervention versus another intervention, outcome: BMD, dichotomous data (*Continued*)

creased risk and guidelines (sent twice) **versus** EMR plus patient-directed intervention (education and reminder)								
(Lafata 2007)** Patient-directed: 2 mailings (educational and reminders) **versus** physician prompt: Electronic Medical Record (EMR) reminder to physician and biweekly mailing plus patient-directed: 2 mailings (educational and reminders)	-	-	720/3367 (21.4%)	1181/4086 (28.9%)	-	-7.5%	-26%	0.7
(Leslie 2012) Physician reminder plus educational material **versus** physician reminder plus educational mate-	-	-	224/1363 (16.4%)	258/1421 (18.2%)	-	-1.7% (NS)	-9%	0.9

Table 7. Osteoporosis studies intervention versus another intervention, outcome: BMD, dichotomous data (*Continued*)

rial plus patient-directed intervention (reminder to see their physician)								
(Rozental 2008) Patient-specific letter to primary-care physician outlining guidelines **versus** orthopaedic surgeon ordering BMD and forwarding results to primary-care physician			7/23 (30.4%)	25/27(92.6%)	-	-62.2%	-67%	0.3
(Solomon 2007a)** Patient-directed (3 mailed letters educational) **versus** physician education following an academic-detailing approach	-	-	249/3274 (7.6%)	183/3574 (5.1%)	-	2.5%	49%	1.5
(Solomon 2007a)** Patient-directed (3 mailed letters educational)	-	-	249/3274 (7.6%)	223/3339 (6.7%)	-	0.9%	14%	1.1

Table 7. Osteoporosis studies intervention versus another intervention, outcome: BMD, dichotomous data (*Continued*)

versus combination of both physician and patient education								
(Solomon 2007a)** Physician education following an academic-detailing approach **versus** combination of both physician and patient education	-	-	183/3574 (5.1%)	223/3339 (6.7%)	-	-1.6%	-23%	0.8

1. Intervention 1 group pre-intervention proportion
2. Intervention 2 group pre-intervention proportion
3. Intervention 1 group post-intervention proportion
4. Intervention 2 group post-intervention proportion
5. ARD = [Int 1 post (%) minus Int 2 post (%)] minus [Int 1 pre (%) minus Int 2 pre (%)]. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
6. Risk Difference (RD) is the absolute % change post-intervention = Int 1 post (%) minus Int 2 post (%). This is considered to be "small" if ≤ 5%, "modest" if > 5% and ≤10%,"moderate" if > 10% but ≤ 20%, and "large" if > 20%.The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome.
7. Relative % change post = absolute % change post divided by Int 2 post (%). The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
8. Risk ratio (RR) = Int 1 post (%) divided by Int 2 post (%)
BMD: bone mineral density; Int 1: intervention 1 group; Int 2: Intervention 2 group; ARD: adjusted risk difference; NS: not significant
* In the study by Bessette 2011, the outcomes reported above include the participants with a diagnosis following the intervention. The women were considered "diagnosed" if they received a BMD test, if they were informed by their physician that they were suffering from osteoporosis and/or if they were initiated on osteoporosis medication. Therefore, the above percentages do not necessarily mean that the women received a BMD test.
**The data reported above for the studies by Lafata 2007 and Solomon 2007b does not account for clustering. We did not have access to sufficient information to adjust the data for clustering.

Table 8. Osteoporosis studies, intervention versus another intervention, outcome: osteoporosis medication, dichotomous data

(Study) Interventions	Int 1 pre (%) [1]	Int 2 pre (%)[2]	Int 1 post (%)[3]	Int 2 post (%)[4]	ARD [5]	Risk difference [6] (P value if reported	Relative % change post [7]	Risk ratio [8]
(Bessette 2011) Patient education, education of physician via the patient, reminder to family physician (for group of patients without diagnosis or treatment at randomisation) **versus** Patient education (including video on osteoporosis), education of physician via the patient, reminder to family physician (for group of patients without diagnosis and treatment at randomisation)	-	-	11.79%	10.64%	-	1.2%	11%	1.1
(Bessette 2011) Patient education, education of physician	-	-	13.49%	12.71%	-	0.8%	6%	1.1

Table 8. Osteoporosis studies, intervention versus another intervention, outcome: osteoporosis medication, dichotomous data (*Continued*)

via the patient, reminder to family physician (for group of patients without diagnosis or treatment at randomisation) **versus** Patient education (including video on osteoporosis), education of physician via the patient, reminder to family physician (for group of patients without treatment at randomisation)								
(Boyd 2002) Patient-specific letter to primary care physician containing information on results and recommendations: standard **versus** extended letter	-	-	11/104 (10.6%)	14/93 (15.1%)	-	-4.5%	-30%	0.7
(Feldstein 2007)	-	-	28/101 (27.7%)	22/110 (20%)	-	7.7%	39%	1.4

Table 8. Osteoporosis studies, intervention versus another intervention, outcome: osteoporosis medication, dichotomous data (*Continued*)

Patient specific Electronic Medical Record (EMR) reminders to primary care provider informing them of patient increased risk and guidelines (sent twice) **versus** EMR plus patient-directed intervention (education and reminder)								
(Lafata 2007)* Patient-directed: 2 mailings (educational and reminders) **versus** physician prompt: Electronic Medical Record (EMR) reminder to physician and biweekly mailing plus patient-directed: 2 mailings (educational and reminders)	-	-	11/128 (8.6%)	15/162 (9.3%)	-	-0.7%	-7%	0.9

Table 8. Osteoporosis studies, intervention versus another intervention, outcome: osteoporosis medication, dichotomous data (*Continued*)

(Leslie 2012) Physician reminder plus educational material **versus** physician reminder plus educational material plus patient-directed intervention (reminder to see their physician)	-	-	200/1363 (14.7%)	234/1421 (16.5%)	-	-1.8% (NS)	-11%	0.9
(Roux 2013) Verbal and written information on osteoporosis to patient and letter with specific management plan sent to their treating physician. Patient reminders at 6 and 12 months. Reminder to physician if patient untreated at 6 months **versus** verbal and written information on	82/275 (29.8%)	65/251 (25.9%)	151/275 (54.9%)	156/251 (62.2%)	-11.2%	-7.2% (P<0.001)	-12%	0.9

Table 8. Osteoporosis studies, intervention versus another intervention, outcome: osteoporosis medication, dichotomous data (*Continued*)

osteoporosis to patient and letter with specific management plan sent to their treating physician. Blood tests and BMD test ordered for patient and results sent to the physician. Patient reminders at 4,8 and 12 months and physician reminders at 4 and 8 months if patient remained untreated								
(Rozental 2008) Patient specific letter to primary care physician outlining guidelines **versus** orthopaedic surgeon ordering BMD and forwarding results to primary-care physician			6/23 (26.1%)	20/27(74.1%)	-	-48%	-65%	0.4
(Solomon 2007a)*	-	-	208/3274 (6.4%)	197/3574 (5.5%)	-	0.8%	15%	1.2

Table 8. Osteoporosis studies, intervention versus another intervention, outcome: osteoporosis medication, dichotomous data (*Continued*)

Patient directed (x3 mailed letters educational) **versus** physician education following an academic detailing approach								
(Solomon 2007a)* Patient directed (x3 mailed letters educational) **versus** combination of both physician and patient education	-	-	208/3274 (6.4%)	236/3339 (7.1%)	-	-0.7%	-10%	0.9
(Solomon 2007a)* Physician education following an academic detailing approach **versus** combination of both physician and patient education	-	-	197/3574 (5.5%)	236/3339 (7.1%)	-	-1.6%	-22%	0.8

1. Intervention 1 group pre-intervention proportion
2. Intervention 2 group pre-intervention proportion
3. Intervention 1 group post-intervention proportion
4. Intervention 2 group post-intervention proportion
5. ARD = [Int 1 post (%) minus Int 2 post (%)] minus [Int 1 pre (%) minus Int 2 pre (%)]. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.

6. Risk Difference (RD) is the absolute % change post-intervention = Int 1 post (%) minus Int 2 post (%). This is considered to be "small" if ≤ 5%, "modest" if > 5% and ≤10%,"moderate" if > 10% but ≤ 20%, and "large" if > 20%.The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome.
7. Relative % change post = absolute % change post divided by Int 2 post (%). The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
8. Risk ratio (RR) = Int 1 post (%) divided by Int 2 post (%)
BMD: bone mineral density; Int 1: intervention 1 group; Int 2: Intervention 2 group; ARD: Adjusted risk difference; NS: not significant
* The data reported above for the studies by Lafata 2007 and Solomon 2007b does not account for clustering. We did not have access to sufficient information to adjust the data for clustering.

Table 9. Low back pain studies, intervention versus control, dichotomous data

(Study) Intervention	Outcome	Int pre (%) [1]	C pre (%) [2]	Int post (%)[3]	C post (%)[4]	ARD [5]	Risk difference [6] (*P value if report*	Relative % change post [7]	Risk ratio [8]
(Bishop 2006) Physician education (guidelines) and 3 patient-specific reminder letters	Education and reassurance according to guideline 0 - 4 weeks post-onset	-	-	10% (16/162)	7% (10/149)		3.2%	47%	1.5
	Exercise according to guideline 0 - 4 weeks post-onset	-	-	38% (62/162)	43% (64/149)		-4.7%	-11%	0.9
	Appropriate medication according to guideline 0 - 4 weeks post-onset	-	-	85% (138/162)	77% (115/149)		8% (P=0.14)	10%	1.1
	Spinal manipulation according to guideline 0 - 4 weeks post-onset	-	-	2.5% (4/162)	6% (9/149)		-3.6%	-59%	0.4

Table 9. Low back pain studies, intervention versus control, dichotomous data (*Continued*)

	Guideline-discordant physician recommended treatment 0 - 4 weeks post-onset	-	-	10% (16/162)	17% (25/149)		6.9% (P=0.05)	41%	0.6
	Supervised exercise programme (recommended treatment 5 - 12 weeks post-onset)	-	-	19% (29/154)	14% (21/149)		4.7% (P=0.11)	34%	1.3
	Return to work (recommended treatment 5 - 12 weeks post-onset)	-	-	24% (37/154)	17% (25/149)		7.2% (P=0.18)	43%	1.4
	Refer to interdisciplinary programme (recommended treatment 5 - 12 weeks post-onset)	-	-	4% (6/154)	2% (3/149)		1.9%	94%	1.9
	Physiotherapy > 4 weeks (guideline-discor-	-	-	41% (63/154)	43% (64/149)		2%	5%	1

Table 9. Low back pain studies, intervention versus control, dichotomous data (*Continued*)

	dant)								
	Continued use of spinal manipulation therapy (guideline-discordant)	-	-	-(no data available)	33% (49/149)		- (P=0.04)	-	
(Bishop 2006) Physician education, reminders and also patient education and 3 reminders	Education and reassurance according to guideline 0 - 4 weeks post-onset	-	-	6% (9/151)	7% (10/149)		-0.8%	-11%	0.9
	Exercise according to guideline 0 - 4 weeks post-onset	-	-	53% (80/151)	43% (64/149)		10% (P=0.05)	23%	1.2
	Appropriate medication according to guideline 0 - 4 weeks post-onset	-	-	81% (122/151)	77% (115/149)		3.6% (P=0.08)	5%	1
	Spinal manipulation according to guideline 0 - 4 weeks post-onset	-	-	5% (8/151)	6% (9/149)		-0.7%	-12%	0.9
	Guideline-discordant physician recommended treatment 0 - 4 weeks	-	-	18% (27/151)	17% (25/149)		-1.1%	-7%	1.1

Table 9. Low back pain studies, intervention versus control, dichotomous data (*Continued*)

	post-onset							
	Supervised exercise programme (recommended treatment 5 - 12 weeks post-onset)	-	-	18% (26/145)	14% (21/149)		3.8% (P=0.07)	27%	1.3
	Return to work (recommended treatment 5 - 12 weeks post-onset)	-	-	23% (33/145)	17% (25/149)		6% (P=0.14)	36%	1.4
	Refer to interdisciplinary programme (recommended treatment 5 - 12 weeks post-onset)	-	-	0	2% (3/149)		-2%	-100%	0
	Physiotherapy > 4 weeks (guideline-discordant)	-	-	42% (61/145)	43% (64/149)		0.9%	2%	1
	Continued use of spinal manipulation ther-	-	-	3% (4/145)	33% (49/149)		30.1% (P=0.05)	92%	0.1

Table 9. Low back pain studies, intervention versus control, dichotomous data (*Continued*)

	apy (guideline-discordant)								
(Dey 2004)* Intervention (aimed at general practitioners): guidelines discussion (educational component), patient information leaflets, access to fast-track physiotherapy and triage services for patients with persistent symptoms (organisational component) versus usual care (control)*	X-ray referrals			15.1% (43/284)	13.7% (42/308)		-1.4% (P=0.62)	-10%	1.1
	Sickness certificates			17.9 % (34/190)	19.2% (40/206)		1.3% (P=0.74)	7%	0.9
	Prescriptions for opioids or muscle relaxants			18.6% (84/452)	18.7% (92/491)		0.1 (P=0.99)	1	1
	Referrals to secondary care			3.4% (33/962)	2.3% (24/1044)		-1.1% (P=0.12)	-49%	1.5
	Referrals to physiotherapy or educational programme	-	-	26.3% (44/167)	13.8% (25/181)	-	-12.6% (P=0.01)	-91%	1.9
(Engers 2005)** Intervention (aimed at general practitioners): guidelines on low	Referral to a therapist	-	-	22.9% (75/328)	27.4% (79/288)	-	4.6%	17%	0.8

Table 9. Low back pain studies, intervention versus control, dichotomous data (*Continued*)

back pain, 2-hour workshop, 2 scientific articles, guidelines on low back pain for occupational physicians, tool for patient education and management-decision tool. Control group: usual care									
	Prescription of pain medication on a time-contingent basis	-	-	70% (139/328)	69% (130/288)	-	2.8%	6%	0.9
	Handed patient information leaflet	-	-	36.9% (121/328)	38.2% (110/288)	-	-1.3%	-3%	1
	Advised patient to stay active	-	-	95.1% (312/328)	89.2% (257/288)	-	5.9%	7%	1.1
	Advised patient to gradually increase activity	-	-	78% (256/328)	65.3% (188/288)	-	12.8%	20%	1.2
	Advised patient which activities to increase at what moment	-	-	18% (58/328)	9% (26/288)	-	8.7%	96%	2
(French 2013)*** Intervention (aimed at general practitioners): Interactive, educational workshops plus educational material	Number of x-ray requests out of total number of patients seen	-	-	0.83% (67/8,085)	1.02% (80/7,826)		0.2% (P=0.2)	19%	0.8

Table 9. Low back pain studies, intervention versus control, dichotomous data (*Continued*)

dissemi-nated (via DVDs); Control group: usual care**									
	Number of CT requests out of to-tal number of patients seen	-	-	0. 61% (64/ 10,419)	0. 66% (66/ 10,085)	-	0.0% (P=0.6)	7%	0.9
(Hazard 1997) Interven-tion (aimed at physicians) : notifi-cation that patient was at a high risk of dis-ability and guidelines on man-agement. Con-trol group: usual care	3-month work ab-sence rates	-	-	28.6% (8/ 28)	24% (6/ 25)	-	-4.6% (NS)	-19%	1.2
(Schectman 2003) Inter-vention (aimed at physicians) : guideline on low back pain, 90-minute educa-tional session on	Lum-bosacral X-ray total utili-sation (% of patients based on episode of care)	31%	21%	19%	18%	9%	-1%	-6%	1.1

Table 9. Low back pain studies, intervention versus control, dichotomous data (*Continued*)

guideline implementation delivered by local opinion leaders and audit report summarising performance against the guideline plus outreach visit. Control group: usual care plus/minus patient education (pamphlet and video)									
	Lumbosacral X-ray not consistent with guideline	14.5%	8.2%	8.1%	8.6%	6.8%	0.5%	6%	0.9
	Lumbosacral CT/MRI total utilisation (% of patients based on episode of care)	7.6%	5.6%	5.6%	7.1%	3.5%	1.5%	21%	0.8
	Lumbosacral CT/MRI not consistent with guideline	5.7%	3.5%	3.5%	5.4%	4.1%	1.9%	35%	0.6
	Physical therapy referral total utilisation (% of patients based on episode of care)	12%	13%	10%	13%	2%	3%	23%	0.8
	Physical therapy referral not consistent	10%	10.9%	9.2%	12%	1.9%	2.8%	23%	0.8

Table 9. Low back pain studies, intervention versus control, dichotomous data (*Continued*)

	with guideline								
	Specialty referral total utilisation (% of patients based on episode of care)	12%	5.9%	8.6%	7.1%	4.6%	-1.5%	-21%	1.2
	Specialty referral not consistent with guideline	9.5%	4%	7.1%	5.6%	4%	-1.5%	-27%	1.3

1. Intervention group pre-intervention proportion
2. Control group pre-intervention proportion
3. Intervention group post-intervention proportion
4. Control group post-intervention proportion
5. ARD = [Int post (%) minus C post (%)] minus [Int pre (%) minus C pre (%)]. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
6. Risk Difference (RD) is the absolute % change post-intervention = Int post (%) minus C post (%). This is considered to be "small" if ≤ 5%, "modest" if > 5% and ≤10%,"moderate" if > 10% but ≤ 20%, and "large" if > 20%.The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
7. Relative % change post = absolute % change post divided by C post (%). The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
8. Risk ratio (RR) = Int post (%) divided by C post (%)
C: control group; Int: intervention group; ARD: adjusted risk difference; NS: not significant
CT/MRI: computed tomography/magnetic resonance imaging
* Dey 2004 reported the Intercluster Correlation (ICC) for the results (mean cluster size=95.1) and this was used to calculate the above effective sample sizes according to chapter 16.3.4 of the Cochrane Handbook, Higgins 2011a.
** The data reported above for the study by Engers 2005 does not account for clustering. We did not have access to sufficient information to adjust the data for clustering.
***French 2013 reported Intercluster Correlation (ICC for x-rays 0.004 and for CTs 0.003, mean cluster size=2,154) and this was used to calculate the above effective sample sizes according to chapter 16.3.4 of the Cochrane Handbook, Higgins 2011a

Table 10. Low back pain studies, intervention 1 versus intervention 2, dichotomous data

(Study) Intervention 1 versus intervention 2	Outcome	Int 1 pre (%) [1]	Int 2 pre (%)[2]	Int 1 post (%)[3]	Int 2 post (%)[4]	ARD [5]	Risk difference [6] (*Pvalue if report*	Relative % change post [7]	Risk ratio [8]

Table 10. Low back pain studies, intervention 1 versus intervention 2, dichotomous data (*Continued*)

(Bishop 2006) Physician education (guidelines) and 3 patient-specific reminder letters versus physician education, reminders and also patient education and 3 reminders	Education and reassurance according to guideline 0 - 4 weeks post-onset	-	-	10% (16/162)	6% (9/151)	-	3.9% (NS)	66%	1.7
	Exercise according to guideline 0 - 4 weeks post-onset	-	-	38% (62/162)	53% (80/151)	-	-14.7% **(P=0.0083)**	-28%	0.7
	Appropriate medication according to guideline 0 - 4 weeks post-onset	-	-	85% (138/162)	81% (122/151)	-	4.4% (NS)	5%	1.1
	Spinal manipulation according to guideline 0 - 4 weeks post-onset	-	-	2.5% (4/162)	5% (13/151)	-	-6.1% **(P=0.018)**	-71%	0.3
	Guideline-discordant physician-recommended treatment 0 - 4 weeks post-onset	-	-	10% (16/162)	18% (27/151)	-	8% **(P=0.04)**	45%	0.6
	Supervised exercise programme (recommended treatment 5 - 12 weeks	-	-	19% (29/154)	18% (26/145)	-	0.9% (NS)	5%	1.1

Table 10. Low back pain studies, intervention 1 versus intervention 2, dichotomous data (*Continued*)

	post-onset)								
	Return to work (recommended treatment 5 - 12 weeks post-onset)	-	-	24% (37/154)	23% (33/145)	-	1.3% (NS)	6%	1.1
	Refer to interdisciplinary programme (recommended treatment 5 - 12 weeks post-onset)	-	-	4% (6/154)	0	-	3.9% **(P=0.02)**	-	-
	Physiotherapy > 4 weeks (guideline-discordant)	-	-	41% (63/154)	42% (61/145)	-	1.2% (NS)	3%	1
	Continued use of spinal manipulation therapy (guideline-discordant)	-	-	- (no data available)	3% (4/145)	-	-	-	-
(Eccles 2001)* Feedback on number of spinal radiographs	Lumbar spine radiographs concordant with guidelines	-	-	35.4% (64/181)	43.6% (120/275)	-	-8.3%	-19%	0.8

Table 10. Low back pain studies, intervention 1 versus intervention 2, dichotomous data (*Continued*)

6 months before and 6 months after the intervention plus guideline dissemination versus guideline dissemination									
(Eccles 2001)* Reminder messages on radiograph reports plus guideline dissemination versus guideline dissemination	Lumbar spine radiographs concordant with guidelines	-	-	41.2% (35/85)	43.6% (120/275)	-	-2.5%	-6%	0.9
(Eccles 2001)* Feedback on number of spinal radiographs 6 months before and 6 months after the intervention plus guideline dissemination plus reminder messages on radiograph reports	Lumbar spine radiographs concordant with guidelines	-	-	36% (89/247)	43.6% (120/275)	-	-7.6%	-17%	0.8

Table 10. Low back pain studies, intervention 1 versus intervention 2, dichotomous data (*Continued*)

versus guideline dissemination									
(Eccles 2001)* Feedback on number of spinal radiographs 6 months before and 6 months after the intervention plus guideline dissemination versus reminder messages on radiograph reports plus guideline dissemination	Lumbar spine radiographs concordant with guidelines	-	-	35.4% (64/181)	41.2% (35/85)	-	-5.8%	-14%	0.9

1. Intervention 1 group pre-intervention proportion
2. Intervention 2 group pre-intervention proportion
3. Intervention 1 group post-intervention proportion
4. Intervention 2 group post-intervention proportion
5. ARD = [Int 1 post (%) minus Int 2 post (%)] minus [Int 1 pre (%) minus Int 2 pre (%)]. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
6. Risk Difference (RD) is the absolute % change post-intervention = Int 1 post (%) minus Int 2 post (%). This is considered to be "small" if ≤ 5%, "modest" if > 5% and ≤10%,"moderate" if > 10% but ≤ 20%, and "large" if > 20%.The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome.
7. Relative % change post = absolute % change post divided by Int 2 post (%). The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
8. Risk ratio (RR) = Int 1 post (%) divided by Int 2 post (%)
Int 1: intervention 1 group; Int 2: Intervention 2 group; ARD: Adjusted risk difference; NS: not significant
*The data reported above for the study by Eccles 2001 does not account for clustering. We did not have access to sufficient information to adjust the data for clustering.

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data

(Study) Intervention 1 versus Intervention 2	Outcome	Int 1 pre mean (SD)[1]	Int 2 pre mean (SD)[2]	Int 1 post mean (SD)[3]	Int 2 post mean (SD)[4]	MD [5]	Relative % change [6]	Adjusted relative % change[7]	SMD[8] (P value)[9]
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing versus guideline dissemination	Functional capacity measured by Hannover Functional Ability Questionnaire at 6 months	-	-	72.9	70.3	2.7	4%	-	0.1 (P=0.12)
(Becker 2008*) Physician education (as above) plus practice nurse training in motivational counselling versus guideline dissemination	Functional capacity measured by Hannover Functional Ability Questionnaire at 6 months	-	-	73.9	70.3	3.6	5%	-	**0.2 (P=0.032)**
(Becker 2008*) Physician education: Guideline (in 4 versions including patient	Days in pain at 6 months	-	-	63.3	80.8	17.4	22%	-	**0.2 (P=0.002)**

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

leaflet), 3 seminars and academic detailing versus guideline dissemination									
(Becker 2008*) Physician education (as above) plus practice nurse training in motivational counselling versus guideline dissemination	Days in pain at 6 months	-	-	62.9	80.8	17.9	22%	-	**0.2 (P=0.001)**
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing versus guideline dissemination	Overall activity at 6 months	-	-	36.5	33.5	3	9%	-	0.1 (P=0.203)
(Becker 2008*) Physician education (as above) plus practice nurse	Overall activity at 6 months	-	-	36.3	33.5	2.8	8%	-	0.1 (P=0.230)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

training in motivational counselling versus guideline dissemination									
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing versus guideline dissemination	Days of sick leave at 6 months	-	-	13	14.3	1.3	9%	-	0 (P=0.569)
(Becker 2008*) Physician education (as above) plus practice nurse training in motivational counselling versus guideline dissemination	Days of sick leave at 6 months	-	-	13	14.3	1.3	9%	-	0 (P=0.584)
(Becker 2008*) Physician education: Guideline (in 4 versions	Quality of life at 6 months	-	-	66.6	66.8	-0.3	0%	-	0 (P=0.847)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

including patient leaflet), 3 seminars and academic detailing versus guideline dissemination									
(Becker 2008*) Physician education (as above) plus practice nurse training in motivational counselling versus guideline dissemination	Quality of life at 6 months	-	-	67.5	66.8	0.7	1%	--	0 (P=0.602)
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing versus guideline dissemination	Functional capacity measured by Hannover Functional Ability Questionnaire at 12 months	-	-	73	71.6	1.4	2%	-	0.1 (P=0.446)
(Becker 2008*) Physician education (as above)	Functional capacity measured by Hannover	-	-	74.6	71.6	3.1	4%	-	0.1 (P=0.088)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

plus practice nurse training in motivational counselling versus guideline dissemination	Functional Ability Questionnaire at 12 months								
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing versus guideline dissemination	Days in pain at 12 months	-	-	58.5	71.3	12.8	18%	-	**0.2 (P=0.018)**
(Becker 2008*) Physician education (as above) plus practice nurse training in motivational counselling versus guideline dissemination	Days in pain at 12 months	-	-	61.6	71.3	9.8	14%	-	0.1 (P=0.067)
(Becker 2008*) Physician education: Guideline	Overall activity at 12 months	-	-	46.4	42.9	3.5	8%	-	0.1 (P=0.202)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

(in 4 versions including patient leaflet), 3 seminars and academic detailing versus guideline dissemination									
(Becker 2008*) Physician education (as above) plus practice nurse training in motivational counselling versus guideline dissemination	Overall activity at 12 months	-	-	45.4	42.9	2.5	6%	-	0.1 (P=0.396)
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing versus guideline dissemination	Days of sick leave at 12 months	-	-	6.2	9.3	3.1	34%	-	0.1 (P=0.256)
(Becker 2008*) Physician	Days of sick leave at 12	-	-	6.5	9.3	2.8	30%	-	0.1 (P=0.320)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

education (as above) plus practice nurse training in motivational counselling versus guideline dissemination	months								
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing versus guideline dissemination	Quality of life at 12 months	-	-	68.5	67.7	0.8	1%	-	0 (P=0.535)
(Becker 2008*) Physician education (as above) plus practice nurse training in motivational counselling versus guideline dissemination	Quality of life at 12 months	-	-	70.4	67.7	2.7	4%	-	**0.1 (P=0.036)**
(Becker 2008*) Physician	Functional capacity measured	-	-	72.9	73.9	-1	-1%	-	0 (NR)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing vs physician education plus practice nurse training in motivational counselling	by Hannover Functional Ability Questionnaire at 6 months								
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing vs physician education plus practice nurse training in motivational counselling	Days in pain at 6 months	-	-	63.3	62.9	-0.4	-1%	-	0 (NR)
(Becker 2008*) Physician education:	Overall activity at 6 months	-	-	36.5	36.3	0.2	0%	-	0 (NR)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing vs physician education plus practice nurse training in motivational counselling									
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing vs Physician education plus practice nurse training in motivational counselling	Days of sick leave at 6 months	-	-	13	13.1	0.1	0%	-	0 (NR)
(Becker 2008*) Physician education: Guideline	Quality of life at 6 months	-	-	66.6	67.5	-0.9	-1%	-	0 (NR)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

(in 4 versions including patient leaflet), 3 seminars and academic detailing vs Physician education plus practice nurse training in motivational counselling									
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing vs Physician education plus practice nurse training in motivational counselling	Functional capacity measured by Hannover Functional Ability Questionnaire at 12 months	-	-	73	74.6	-1.7	-2%	-	-0.1 (NR)
(Becker 2008*) Physician education: Guideline (in 4	Days in pain at 12 months	-	-	58.5	61.6	3.1	5%	-	0 (NR)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

versions including patient leaflet), 3 seminars and academic detailing vs Physician education plus practice nurse training in motivational counselling									
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing vs Physician education plus practice nurse training in motivational counselling	Overall activity at 12 months	-	-	46.4	45.4	1	2%	-	0 (NR)
(Becker 2008*) Physician education: Guideline (in 4 versions	Days of sick leave at 12 months	-	-	6.2	6.458	0.3	5%	-	0 (NR)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

including patient leaflet), 3 seminars and academic detailing vs Physician education plus practice nurse training in motivational counselling									
(Becker 2008*) Physician education: Guideline (in 4 versions including patient leaflet), 3 seminars and academic detailing vs Physician education plus practice nurse training in motivational counselling	Quality of life at 12 months	-	-	68.5	70.4	-1.9	-3%	-	-0.1 (NR)
(Eccles 2001)* Feedback on number of spinal radiographs 6 months	Number of lumbar spine radiographs per 1000 patients	7.24 (4.8)	7.53 (4.1)	5.97 (4.2)	6.80 (4.3)	0.83	12%	8%	0.2 (NR)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

before and 6 months after the intervention plus guideline dissemination versus guideline dissemination									
(Eccles 2001)* Reminder messages on radiograph reports plus guideline dissemination versus guideline dissemination	Number of lumbar spine radiographs per 1000 patients	7.31 (5.2)	7.53 (4.1)	5.14 (3.7)	6.80 (4.3)	1.66	24%	21%	0.4 **(P=0.05)**
(Eccles 2001)* Feedback on number of spinal radiographs 6 months before and 6 months after the intervention plus guideline dissemination plus reminder messages on radiograph reports versus	Number of lumbar spine radiographs per 1000 patients	8.30 (5.1)	7.53 (4.1)	5.23 (3.7)	6.80 (4.3)	1.57	23%	34%	0.4 (NR)

Table 11. Low back pain studies intervention 1 versus intervention 2, continuous data (*Continued*)

guideline dissemination									
(Eccles 2001)* Feedback on number of spinal radiographs 6 months before and 6 months after the intervention plus guideline dissemination versus reminder messages on radiograph reports plus guideline dissemination	Number of lumbar spine radiographs per 1000 patients	7.24 (4.8)	7.31 (5.2)	5.97 (4.2)	5.14 (3.7)	-0.83	-16%	-18%	-0.2 (NR)

1. Intervention 1 group pre-intervention mean (standard deviation)
2. Intervention 2 group pre-intervention mean (standard deviation)
3. Intervention 1 group post-intervention mean (standard deviation)
4. Intervention 2 group postintervention mean (standard deviation)
5. Mean Difference (MD)=Difference between post-intervention means. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
6. Relative percentage change post-intervention = (Int1 post mean - Int2 post mean)/Int2 post mean. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
7. Adjusted relative percentage change= (Int1 post mean-Int2 post mean)-(Int1 pre mean - Int2 pre mean)/Int2 post mean. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome.
8. SMD=Standardised Mean Difference=(Int1 post mean-Int2 post mean)/SD pooled. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
9. P value reported by study authors
Int 1: intervention 1 group; Int 2: Intervention 2 group; NR: not reported; SD: standard deviation
*The data reported above for Becker 2008 and Eccles 2001 was adjusted for clustering by the authors

Table 12. Low back pain, interrupted time series studies, imaging outcomes

Study	Intervention	Outcome	Mean pre (SD)	Mean post (SD)	Mean post minus mean pre	Relative % change pre to post	SMD pre to post	Mean change in level (p value)	Mean change in slope (p value)
Hollingworth 2002	Educational material	Back x-rays ordered	1133 (50)	1208.7 (111.5)	-75.7	-6.7	-1.51	-121.5 (P = 0.167)	6.8 (P = 0.776)

Table 13. Osteoarthritis studies: Intervention versus control (continuous data)

(Study) Intervention	Outcome	Int pre mean (SD)[1]	C pre mean (SD)[2]	Int post mean (SD)[3]	C post mean (SD)[4]	MD [5]	Relative % change [6]	Adjusted relative % change[7]	SMD[8] (P value)[9]
(Chassany 2006)* GP training on relationships and communication, pain evaluation, prescription and negotiation of a patient contract delivered in a 4-hour interactive session plus 8 reminders on recommendations	Pain relief (SPID)	-	-	315.6 (289.5)	264.7 (242.9)	50.9	19%	19%	0.2 **(P< 0.0001)**
	Intensity of pain in motion on VAS	63.7 (13.8)	62.8 (13.5)	-29 (23.1)	-24.8 (21.1)	4.2	17%	-21%	0.2 **(P=0.01)**
	Lequesne Index	9.2 (2.9)	9.8 (3.2)	-2.5 (2.5)	-2.0 (2.4)	0.5	25%	5%	0.2 **(P< 0.0001)**
	WOMAC index pain	9.3 (3.0)	9.6 (2.8)	-2.9 (3.4)	-2.2 (2.9)	0.7	32%	-18%	0.2 **(P< 0.0001)**
	WOMAC index stiffness	4.1 (1.4)	4.0 (1.4)	-1.2 (1.6)	-0.8 (1.4)	0.4	50%	-62%	0.3 **(P=0.0004)**
	WOMAC index physical function	31.2 (10.9)	32.8 (9.5)	-8.7 (10.7)	-6.1 (8.8)	2.6	43%	-16%	0.3 **(P< 0.0001)**
	WOMAC index global score	44.6 (14.4)	46.4 (12.5)	-12.9 (14.8)	-9.2 (12.2)	3.7	40%	-21%	0.3 **(P< 0.0001)**
	Acetaminophen consumption	-	-	3400 (800)	2900 (900)	-500	-17%	-17%	-0.6 **(P< 0.0001)**

Table 13. Osteoarthritis studies: Intervention versus control (continuous data) (*Continued*)

(Rosemann 2007)* Intervention (aimed at GPs): 2 interactive 8-hour meetings focusing on arthritis self management, guideline dissemination and patient information material versus control (usual care)	Quality of life (AIMS2-SF scores) Lower body	2.67 (1.88)	2.65 (1.85)	2.48	2.62	-0.14	-5%	-6%	-0.1 (P=0.349)
	Quality of life (AIMS2-SF scores) Upper body	1.47 (2.25)	1.33 (2.09)	1.43	1.34	0.09	7%	-4%	0.1 P=0.694)
	Quality of life (AIMS2-SF scores) Symptom	4.87 (2.13)	4.81 (2.18)	4.51	4.72	-0.21	-4%	-6%	-0.2 (P=0.119)
	Quality of life (AIMS2-SF scores) Affect	2.89 (1.35)	2.88 (1.33)	2.92	2.83	0.09	3%	3%	0.1 (P=0.610)
	Quality of life (AIMS2-SF scores) Social	4.52 (1.88)	4.69 (1.80)	4.43	4.62	-0.19	-4%	0%	-0.3 P=0.776
	GP contacts	4.56 (6.13)	4.82 (6.00)	4.44	4.6	0.16	3%	-2%	0.1 (P=0.339)
	Referrals to orthopaedics	1.58 (3.43)	1.76 (3.52)	1.49	1.75	0.26	15%	5%	0.8 (P=0.153)
	Radiographs	0.82 (3.12)	0.79 (2.78)	0.75	0.85	0.1	12%	15%	0.2 **(P=0.05)**
	Non-medical practitioners	0.11 (3.01)	0.36 (3.28)	0.09	0.32	0.23	72%	-6%	0.6 (P=0.687)
	Physiotherapy	4.70 (9.10)	5.81 (11.10)	4.63	5.77	1.14	20%	1%	2 (P=0.242)

Table 13. Osteoarthritis studies: Intervention versus control (continuous data) (*Continued*)

	Acupuncture	0.83 (3.45)	0.97 (3.80)	0.8	0.97	0.17	18%	3%	0.2 (P=0.821)
(Rosemann 2007)* Intervention (aimed at GPs) as above plus patient case management via telephone by practice nurses versus control (usual care)	Quality of life (AIMS2-SF scores) Lower body	3.01 (2.11)	2.65 (1.85)	2.61	2.62	-0.01	0%	-14%	0 **(P=0.049)**
	Quality of life (AIMS2-SF scores) Upper body	1.68 (2.44)	1.33 (2.09)	1.62	1.34	0.28	21%	-5%	0.2 (P=0.621)
	Quality of life (AIMS2-SF scores) Symptom	5.02 (2.29)	4.81 (2.18)	4.42	4.72	-0.3	-6%	-11%	-0.2 **(P=0.048)**
	Quality of life (AIMS2-SF scores) Affect	3.04 (1.39)	2.88 (1.33)	2.98	2.83	0.15	5%	0%	0.2 (P=0.691)
	Quality of life (AIMS2-SF scores) Social	4.79 (1.80)	4.69 (1.80)	4.736	4.62	0.116	3%	0%	0.1 **(P< 0.001)**
	GP contacts	5.01 (5.78)	4.82 (6.00)	4.9	4.6	-0.3	-7%	-2%	-0.2 (P=0.823)
	Referrals to orthopaedics	1.76 (3.52)	1.76 (3.52)	1.52	1.75	0.23	13%	13%	0.2 **(P=0.044)**
	Radiographs	0.80 (3.01)	0.79 (2.78)	0.71	0.85	0.14	16%	18%	0.4 **(P=0.031)**
	Non-medical practitioners	0.50 (4.20)	0.36 (3.28)	0.47	0.32	-0.15	-47%	-3%	-0.4 (P=0.225)

Table 13. Osteoarthritis studies: Intervention versus control (continuous data) (*Continued*)

	Physio-therapy	5.22 (10.03)	5.81 (11.10)	5.08	5.77	0.69	12%	2%	1.3 (P=0.129)
	Acupuncture	0.77 (3.99)	0.97 (3.80)	0.72	1.09	0.37	34%	16%	0.4 (P=0.769)
(Stross 1985)** Intervention: Educationally-influential physicians (EIs) led education of primary-care physicians: self-study programme including textbook, audio-visual materials and recent articles on osteoarthritis versus control (usual care)	Length of stay for OA patients	8.8	8.4	8.4	8.6	0.2	2%	7%	NR
	Length of stay for total hip arthroplasty (THA) patients	17.2	16.6	15.2	16.0	0.8	5%	9%	NR

1. Intervention group pre-intervention mean (standard deviation)
2. Control group pre-intervention mean (standard deviation)
3. Intervention group post-intervention mean (standard deviation)
4. Control group pos-tintervention mean (standard deviation)
5. Mean Difference (MD)=Difference between post-intervention means. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
6. Relative percentage change post-intervention = (Int post mean - Control post mean)/Control post mean
7. Adjusted relative percentage change= (Int post mean-Control post mean)-(Int pre mean - Control pre mean)/Control post mean. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome.
8. SMD=Standardised Mean Difference=(Int post mean-Control post mean)/SD pooled. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
9. P value reported by study authors
AIMS2-SF: Arthritis Impact Measurement Scales Short Form
WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index
* There are potential unit of analysis errors in the reported results as the study did not account for clustering and did not provide sufficient data to allow an approximate analysis according to chapter 16.3.4 of the Cochrane Handbook, Higgins 2011a.

**The study did not report standard deviations and therefore we were unable to calculate the SMD. There are potential unit of analysis errors in the reported results as the study did not account for clustering and did not provide sufficient data to allow an approximate analysis according to chapter 16.3.4 of the Cochrane Handbook, Higgins 2011a.

Table 14. Osteoarthritis studies: intervention versus control (dichotomous data)

(Study) Intervention	Outcome	Int pre (%) [1]	C pre (%) [2]	Int post (%)[3]	C post (%)[4]	ARD [5]	Risk difference [6] (PValueifreport	Relative % change post [7]	Risk ratio [8]
(Rahme 2005)* Intervention (aimed at GPs): 90-minute workshop on management of osteoarthritis versus control group (usual care)	Number of adequate prescription, according to the guidelines	51% (273/536)	47% (675/1437)	56% (251/450)	49% (593/1209)	3%	7%	14%	1.1
(Rahme 2005)* Intervention (aimed at GPs): decision tree on treatment choices for osteoarthritis patients versus control (usual care)	Number of adequate prescription, according to the guidelines	51% (799/1569)	47% (675/1437)	54% (712/1317)	49% (593/1209)	1%	5%	10%	1.1
(Rahme 2005)* Intervention (aimed at GPs): 90-	Number of adequate prescription, accord-	58% (1022/1776)	47% (675/1437)	62% (1008/1634)	49% (593/1209)	2%	13%	26%	1.3

Table 14. Osteoarthritis studies: intervention versus control (dichotomous data) (*Continued*)

minute workshop and decision tree as above versus control (usual care)	ing to the guidelines								
(Rosemann 2007)* Intervention (aimed at GPs): 2 interactive 8-hour meetings focusing on arthritis self management, guideline dissemination and patient information material versus control (usual care)	Paracetamol prescriptions	8.9% (31/345)	6.6% (22/332)	16.4%	5.3%	8.7%	11.1% (**<0.001**)	209%	3.1
	Opioids	5.8% (20/345)	6.9% (23/332)	10.1%	7.9%	3.4%	2.2% (NS)	28%	1.3
	NSAID	40% (138/345)	41.9% (139/332)	44.3%	44.2%	2.0%	0.1% (NS)	23%	1.0
	Homeopathics	6.1% (21/345)	8.1% (27/332)	7.7%	9.8%	-0.1%	-2.2% (NS)	-22%	0.8
(Rosemann 2007)* Intervention (aimed at GPs) as above plus patient case management via telephone by practice nurses versus con-	Paracetamol prescriptions	7.3% (25/345)	6.6% (22/332)	14.1%	5.3%	8.2%	8.8% (**<0.01**)	166%	2.7

Table 14. Osteoarthritis studies: intervention versus control (dichotomous data) (*Continued*)

trol (usual care)									
	Opioids	7.3% (25/345)	6.9% (23/332)	16.0%	7.9%	7.8%	8.1% (**< 0.01**)	102%	2.0
	NSAID	43.3% (149/345)	41.9% (139/332)	49.7%	44.2%	4.3%	5.6% (**0.019**)	13%	1.1
	Homeopathics	6.7% (23/345)	8.1% (27/332)	9.6%	9.8%	1.2%	-0.2% (NS)	-2%	1.0
(Stross 1985)* Intervention: Educationally-influential physicians (EIs) led education of primary-care physicians: self-study programme including textbook, audio-visual materials and recent articles on osteoarthritis versus control (usual care)	Management of OA patients with aspirin	39% (9/23)	50% (9/18)	20% (6/30)	28% (5/18)	3%	-8%	-28%	0.7
	Management of OA patients with NSAIDs	83% (19/23)	78% (14/18)	87% (26/30)	94% (17/18)	-13%	-8%	-8%	0.9
	Management of OA patients with systemic corticosteroids	13% (3/23)	17% (3/18)	3% (1/30)	22% (4/18)	15%	19% (**< 0.05**)	85%	0.2
	Management of OA patients with intra-articular corticosteroids	17% (4/23)	11% (2/18)	40% (12/30)	11% (2/18)	23%	29% (**<0.05**)	260%	3.6
	Management of OA patients with physical therapy	87% (20/23)	83% (15/18)	93% (28/30)	83% (15/18)	6%	10%	12%	1.1

Table 14. Osteoarthritis studies: intervention versus control (dichotomous data) (*Continued*)

	Referral of OA patients	39% (9/23)	39% (7/18)	30% (9/30)	33% (6/18)	-4%	3%	10%	0.9
	Pre-op physical therapy of THA patients	56% (10/18)	46% (12/26)	97% (35/36)	40% (12/30)	48%	57% (**< 0.05**)	143%	2.4
	Post-op narcotics of THA patients	72% (13/18)	77% (20/26)	89% (32/36)	93% (28/30)	0%	4%	5%	1.0
	Post-op physical therapy of THA patients	100% (18/18)	100% (26/26)	100% (36/36)	100% (30/30)	0%	0%	0%	1.0
	Post-op complications of THA patients	11% (2/18)	15% (4/26)	6% (2/36)	13% (4/30)	4%	8%	58%	0.4

1. Intervention group pre-intervention proportion
2. Control group pre-intervention proportion
3. Intervention group post-intervention proportion
4. Control group post-intervention proportion
5. ARD = [Int post (%) minus C post (%)] minus [Int pre (%) minus C pre (%)]. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
6. Risk Difference (RD) is the absolute % change post-intervention = Int post (%) minus C post (%). This is considered to be "small" if ≤ 5%, "modest" if > 5% and ≤10%,"moderate" if > 10% but ≤ 20%, and "large" if > 20%.The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
7. Relative % change post = absolute % change post divided by C post (%). The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
8. Risk ratio (RR) = Int post (%) divided by C post (%)
C: control group; Int: intervention group; ARD: Adjusted risk difference; NS: not significant
NSAID: non-steroidal anti-inflammatory drug, THA: total hip arthroplasty
* There are unit of analysis errors in the reported results because the available data did not account for the effect of clustering.

Table 15. Osteoarthritis studies: intervention 1 versus intervention 2, dichotomous data

(Study) Intervention 1 versus intervention 2	Outcome	Int 1 pre (%) [1]	Int 2 pre (%)[2]	Int 1 post (%)[3]	Int 2 post (%)[4]	ARD [5]	Risk difference [6] (*P value if report*	Relative % change post [7]	Risk ratio [8]
(Rahme 2005)* Intervention 1 (aimed at GPs): 90-minute workshop on management of osteoarthritis versus Intervention 2 (aimed at GPs): decision tree on treatment choices for osteoarthritis patients	Number of adequate prescription, according to the guidelines	51% (273/536)	51% (799/1569)	56% (251/450)	54% (712/1317)	1.7%	1.7%	3%	1
(Rahme 2005)* Intervention 1 (aimed at GPs): 90-minute workshop on management of osteoarthritis versus Intervention 2 (aimed at GPs): 90-minute workshop and deci-	Number of adequate prescription, according to the guidelines	51% (273/536)	58% (1022/1776)	56% (251/450)	62% (1008/1634)	0.7%	-5.9%	-10%	0.9

Table 15. Osteoarthritis studies: intervention 1 versus intervention 2, dichotomous data (*Continued*)

sion tree									
(Rahme 2005)* Intervention 1 (aimed at GPs):decision tree on treatment choices for osteoarthritis patients versus Intervention 2 (aimed at GPs): 90-minute workshop and decision tree	Number of adequate prescription, according to the guidelines	51% (799/1569)	58% (1022/1776)	54% (712/1317)	62% (1008/1634)	-1%	-7.6%	-12%	0.9
(Rosemann 2007)* Intervention (aimed at GPs): 2 interactive 8-hour meetings focusing on arthritis self management, guideline dissemination and patient information material versus Intervention (aimed at GPs) as above plus pa-	Paracetamol prescriptions	8.9% (31/345)	7.3% (25/345)	16.4%	14.1%	0.5%	2.3%	16%	1.2

Table 15. Osteoarthritis studies: intervention 1 versus intervention 2, dichotomous data (*Continued*)

tient case management via telephone by practice nurses									
	Opioids	5.8% (20/345)	7.3% (25/345)	10.1%	16.0%	-4.5%	-5.9%	-37%	1.2
	NSAID	40% (138/345)	43.3% (149/345)	44.3%	49.7%	-2.2%	-5.4%	-11%	1.2
	Homeopathics	6.1% (21/345)	6.7% (23/345)	7.7%	9.6%	-1.4%	-1.9%	-20%	1.2

1. Intervention 1 group pre-intervention proportion
2. Intervention 2 group pre-intervention proportion
3. Intervention 1 group post-intervention proportion
4. Intervention 2 group post-intervention proportion
5. ARD = [Int 1 post (%) minus Int 2 post (%)] minus [Int 1 pre (%) minus Int 2 pre (%)]. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
6. Risk Difference (RD) is the absolute % change post-intervention = Int 1 post (%) minus Int 2 post (%). This is considered to be "small" if ≤ 5%, "modest" if > 5% and ≤10%,"moderate" if > 10% but ≤ 20%, and "large" if > 20%.The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome.
7. Relative % change post = absolute % change post divided by Int 2 post (%). The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
8. Risk ratio (RR) = Int 1 post (%) divided by Int 2 post (%)
Int 1: intervention 1 group; Int 2: Intervention 2 group; ARD: adjusted risk difference; NS: not significant, NSAID: non-steroidal anti-inflammatory drug
* There are unit of analysis errors in the reported results because the available data did not account for the effect of clustering.

Table 16. Osteoarthritis studies: intervention 1 versus intervention 2 continuous data

(Study) Intervention 1 versus Intervention 2	Outcome	Int 1 pre mean (SD)[1]	Int 2 pre mean (SD)[2]	Int 1 post mean (SD)[3]	Int 2 post mean (SD)[4]	MD [5]	Relative % change [6]	Adjusted relative % change[7]	SMD[8] (P value)[9]
(Rosemann 2007)* Intervention (aimed at GPs): 2 interactive 8-hour meetings	Quality of life (AIMS2-SF scores) Lower body	2.67 (1.88)	3.01 (2.11)	2.48 (1.1)	2.61 (1.4)	-0.13	-5%	0%	-0.1

Table 16. Osteoarthritis studies: intervention 1 versus intervention 2 continuous data (*Continued*)

focusing on arthritis self management, guideline dissemination and patient information material versus Intervention (aimed at GPs) as above plus patient case management via telephone by practice nurses									
	Quality of life (AIMS2-SF scores) Upper body	1.47 (2.25)	1.68 (2.44)	1.43 (1.5)	1.62 (1.3)	-0.19	-12%	-6%	-0.1
	Quality of life (AIMS2-SF scores) Symptom	4.87 (2.13)	5.02 (2.29)	4.51 (1.0)	4.42 (1.8)	0.09	2%	12%	0.1
	Quality of life (AIMS2-SF scores) Affect	2.89 (1.35)	3.04 (1.39)	2.92 (0.8)	2.98 (0.9)	-0.06	-2%	-1%	-0.1
	Quality of life (AIMS2-SF scores) Social	4.52 (1.88)	4.79 (1.80)	4.43 (0.6)	4.736 (1.2)	-0.31	-6%	-25%	-0.3
	GP contacts	4.56 (6.13)	5.01 (5.78)	4.44 (1.7)	4.9 (1.6)	0.46	9%	37%	0.3
	Referrals to orthopaedics	1.58 (3.43)	1.76 (3.52)	1.49 (0.4)	1.52 (1.3)	0.03	2%	-9%	0.0
	Radiographs	0.82 (3.12)	0.80 (3.01)	0.75 (0.6)	0.71 (0.4)	-0.04	-6%	-1%	-0.1
	Non-medical practitioners	0.11 (3.01)	0.50 (4.20)	0.09 (0.4)	0.47 (0.4)	0.38	81%	-45%	0.9
	Physiotherapy	4.70 (9.10)	5.22 (10.03)	4.63 (0.6)	5.08 (0.6)	0.45	9%	35%	0.7

Table 16. Osteoarthritis studies: intervention 1 versus intervention 2 continuous data (*Continued*)

	Acupuncture	0.83 (3.45)	0.77 (3.99)	0.8 (1.3)	0.72 (1.3)	-0.08	-11%	0%	-0.1

1. Intervention 1 group pre-intervention mean (standard deviation)
2. Intervention 2 group pre-intervention mean (standard deviation)
3. Intervention 1 group post-intervention mean (standard deviation)
4. Intervention 2 group postintervention mean (standard deviation)
5. Mean Difference (MD)=Difference between post-intervention means. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
6. Relative percentage change post-intervention = (Int1 post mean - Int2 post mean)/Int2 post mean. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
7. Adjusted relative percentage change= (Int1 post mean-Int2 post mean)-(Int1 pre mean - Int2 pre mean)/Int2 post mean. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome.
8. SMD=Standardised Mean Difference=(Int1 post mean-Int2 post mean)/SD pooled. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
9. P value reported by study authors
AIMS2-SF: Arthritis Impact Measurement Scales Short Form
* There are unit of analysis errors in the reported results because the available data did not account for the effect of clustering.

Table 17. Shoulder studies: intervention versus control, continuous data

(Study) Intervention	Outcome	Int pre mean (SD)[1]	C pre mean (SD)[2]	Int post mean (SD)[3]	C post mean (SD)[4]	MD [5]	Relative % change [6]	Adjusted relative % change[7]	SMD[8] (P value)[9]
(Watson 2008) Intervention: 60-minute lecture on shoulder disorders, handouts, training in injection techniques versus control group (usual care)	British Shoulder Disability Questionnaire (BSDQ)	12.22 (4.21)	13.11 (4.43)	8.51 (0.60)	9.46 (0.82)	0.95	10%	1%	0.2 (P=0.36)
	Short form 36 item (SF-36) Health	37.78 (8.69)	35.96 (8.93)	40.55 (0.60)	40.80 (0.90)	-0.25	-1%	-5%	0.0 (P=0.82)

Table 17. Shoulder studies: intervention versus control, continuous data *(Continued)*

	Survey - physical component score								
	Short form 36 item (SF-36) Health Survey - mental component score	45.42 (13.33)	44.64 (13.09)	46.81 (0.93)	45.64 (1.28)	1.17	3%	1%	0.1 (P=0.47)

1. Intervention group pre-intervention mean (standard deviation)
2. Control group pre-intervention mean (standard deviation)
3. Intervention group post-intervention mean (standard deviation)
4. Control group pos-tintervention mean (standard deviation)
5. Mean Difference (MD)=Difference between post-intervention means. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
6. Relative percentage change post-intervention = (Int post mean - Control post mean)/Control post mean
7. Adjusted relative percentage change= (Int post mean-Control post mean)-(Int pre mean - Control pre mean)/Control post mean. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome.
8. SMD=Standardised Mean Difference=(Int post mean-Control post mean)/SD pooled. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
9. P value reported by study authors

Table 18. Shoulder studies: intervention 1 versus intervention 2, continuous data

(Study) Intervention 1 versus Intervention 2	Outcome	Int 1 pre mean (SD)[1]	Int 2 pre mean (SD)[2]	Int 1 post mean (SD)[3]	Int 2 post mean (SD)[4]	MD [5]	Relative % change [6]	Adjusted relative % change[7]	SMD[8] (P value)[9]
(Gormley 2003*) Shoulder injection training on mannequins versus shoulder injection training on man-	Shoulder injections performed by general practitioner	3.5	3.4	4.5	7.8	-3.3	-42%	-44%	(P=0.02)

Table 18. Shoulder studies: intervention 1 versus intervention 2, continuous data (*Continued*)

nequins and real patients									
	Referrals to shoulder injection clinics	2.3	2.0	1.5	0.6	-0.9	-150%	-100%	(P=0.36)
	Referrals to physiotherapy	5.9	5.6	4.7	3.2	-1.5	-47%	-38%	(P=0.20)

1. Intervention 1 group pre-intervention mean (standard deviation)
2. Intervention 2 group pre-intervention mean (standard deviation)
3. Intervention 1 group post-intervention mean (standard deviation)
4. Intervention 2 group postintervention mean (standard deviation)
5. Mean Difference (MD)=Difference between post-intervention means. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
6. Relative percentage change post-intervention = (Int1 post mean - Int2 post mean)/Int2 post mean. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
7. Adjusted relative percentage change= (Int1 post mean-Int2 post mean)-(Int1 pre mean - Int2 pre mean)/Int2 post mean. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome.
8. SMD=Standardised Mean Difference=(Int1 post mean-Int2 post mean)/SD pooled. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
9. P value reported by study authors
* The study does not report SD and therefore we were not able to calculate the SMD

Table 19. Other musculoskeletal conditions studies: Intervention versus control, continuous data

(Study) Intervention	Outcome	Int pre mean (SD)[1]	C pre mean (SD)[2]	Int post mean (SD)[3]	C post mean (SD)[4]	MD [5]	Relative % change [6]	Adjusted relative % change[7]	SMD[8] (P value)[9]
(Huas 2006) Training of general practitioners on the use of 2 validated assessment instruments for pain versus con-	Pain relief a week after last consultation with general practitioner			41.1 (4.6)	50.7 (4.8)	-9.6	-19%		-2 **(P=0.0004)**

Table 19. Other musculoskeletal conditions studies: Intervention versus control, continuous data (*Continued*)

trol group (usual care)									
	Pain relief a week after last consultation with general practitioner not including patients on Level 3 analgesics			40.8 (4.0)	50.7 (4.2)	-9.9	-20%		-2.4 **(P=0.0001)**
	Level 1 analgesic treatment (as defined by WHO classification system)	34.7 (10.6)	42.9 (18.4)	29.6 (9.9)	34.2 (12.4)	-4.6	-13%	11%	-0.3 (P=0.38)
	Level 2 analgesic treatment (as defined by WHO classification system)	42.2 (5.9)	44.1 (19.6)	35.4 (6.3)	47.7 (8.8)	-12.3	-26%	-22%	-0.9 **(P=0.003)**
	Level 3 analgesic treatment (as defined by WHO classification system)	7.5 (5.6)	2.5 (2.1)	7.2 (4.7)	1.8 (2.5)	5.4	300%	22%	1.2 **(P=0.007)**
	Co-analgesics (antidepressants, anxiolytics,	46.0 (7.6)	38.7 (7.5)	38.4 (11.4)	33.0 (15.1)	5.4	16%	-6%	0.7 (P=0.38)

Table 19. Other musculoskeletal conditions studies: Intervention versus control, continuous data (*Continued*)

	anti-epileptics)								
	Other drugs (non-psychotropic muscle relaxants)	21.6 (7.1)	27.3 (13.5)	19.0 (5.3)	22.9 (11.5)	-3.9	-17%	8%	-0.4 (P=0.34)
	Non-medicinal treatment (physiotherapy, homeopathy, acupuncture, compression bandages, etc)	44.3 (10.2)	44.9 (11.1)	33.8 (11.8)	39.3 (12.5)	-5.5	-14%	-12%	-0.5 (P=0.30)

1. Intervention group pre-intervention mean (standard deviation)
2. Control group pre-intervention mean (standard deviation)
3. Intervention group post-intervention mean (standard deviation)
4. Control group pos-tintervention mean (standard deviation)
5. Mean Difference (MD)=Difference between post-intervention means. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
6. Relative percentage change post-intervention = (Int post mean - Control post mean)/Control post mean
7. Adjusted relative percentage change= (Int post mean-Control post mean)-(Int pre mean - Control pre mean)/Control post mean. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome.
8. SMD=Standardised Mean Difference=(Int post mean-Control post mean)/SD pooled. The direction of effect has been adjusted so that a positive result represents a beneficial intervention outcome, according to Grimshaw 2004.
9. P value reported by study authors

Table 20. Other musculoskeletal studies: Intervention versus a different intervention, dichotomous data

(Study) Intervention 1 versus intervention 2	Outcome	Int 1 pre (%) [1]	Int 2 pre (%)[2]	Int 1 post (%)[3]	Int 2 post (%)[4]	ARD [5]	Risk difference [6] (*Pvalueifreport*	Relative % change post [7]	Risk ratio [8]
(Robling 2002)* Guidelines and semi-	Concordant requests	-	-	79% (23/29)	79% (32/41)	-	0%	0%	1

Table 20. Other musculoskeletal studies: Intervention versus a different intervention, dichotomous data (*Continued*)

nar versus guideline dissemination by post*									
(Robling 2002)* Guidelines and feedback versus guideline dissemination by post*	Concordant requests	-	-	67% (21/32)	79% (32/41)	-	-12.1%	-15%	0.8
(Robling 2002)* Guidelines, seminar and feedback versus guideline dissemination by post*	Concordant requests	-	-	71% (27/37)	79% (32/41)	-	-7.6%	-10%	0.9
(Robling 2002)* Guidelines and seminar versus guidelines and feedback*	Concordant requests	-	-	79% (23/29	67% (21/32)	-	12.1%	18%	1.2
(Robling 2002)* Guidelines and seminar versus guidelines, seminar and feedback*	Concordant requests	-	-	79% (23/29)	71% (27/37)	-	7.6%	11%	1.1
(Robling 2002)*	Concordant re-	-	-	67% (21/32)	71% (27/37)	-	-4.5%	-6%	0.9

Table 20. Other musculoskeletal studies: Intervention versus a different intervention, dichotomous data (*Continued*)

Guidelines and feedback versus guidelines, seminar and feedback*	quests								
(Eccles 2001)** Feedback on number of knee radiographs 6 months before and 6 months after the intervention plus guideline dissemination versus guideline dissemination	Knee radiographs concordant with guidelines	-	-	22% (52/240)	25% (83/328)	-	-3.6%	-14%	0.9
(Eccles 2001)** Reminder messages on radiograph reports plus guideline dissemination versus guideline dissemination	Knee radiographs concordant with guidelines	-	-	31% (26/85)	25% (83/328)	-	5.3%	21%	1.2
(Eccles 2001)** Feedback on number of knee radiographs 6 months	Knee radiographs concordant with guidelines	-	-	28% (70/252)	25% (83/328)	-	2.5%	10%	1.1

Table 20. Other musculoskeletal studies: Intervention versus a different intervention, dichotomous data (*Continued*)

before and 6 months after the intervention plus guideline dissemination plus reminder messages on radiograph reports versus guideline dissemination									
(Eccles 2001)** Feedback on number of knee radiographs 6 months before and 6 months after the intervention plus guideline dissemination versus reminder messages on radiograph reports plus guideline dissemination	Knee radiographs concordant with guidelines	-	-	22% (52/240)	31% (26/85)	-	-8.9%	-29%	0.7

1. Intervention 1 group pre-intervention proportion
2. Intervention 2 group pre-intervention proportion
3. Intervention 1 group post-intervention proportion
4. Intervention 2 group post-intervention proportion
5. ARD = [Int 1 post (%) minus Int 2 post (%)] minus [Int 1 pre (%) minus Int 2 pre (%)]. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.

6. Risk Difference (RD) is the absolute % change post-intervention = Int 1 post (%) minus Int 2 post (%). This is considered to be "small" if ≤ 5%, "modest" if > 5% and ≤10%,"moderate" if > 10% but ≤ 20%, and "large" if > 20%.The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome.
7. Relative % change post = absolute % change post divided by Int 2 post (%). The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
8. Risk ratio (RR) = Int 1 post (%) divided by Int 2 post (%)
Int 1: intervention 1 group; Int 2: Intervention 2 group; ARD: adjusted risk difference; NS: not significant
*The results have been re-calculated taking into account the reported Intercluster Correlation (ICC=0.0269) and average cluster size 12.5 according to chapter 16.3.4 of the Cochrane Handbook, Higgins 2011a.
** The data reported above for the study by Eccles 2001 does not account for clustering. We did not have access to sufficient information to adjust the data for clustering.

Table 21. Other musculoskeletal studies: Intervention versus a different intervention, continuous data

(Study) Intervention 1 versus Intervention 2	Outcome	Int 1 pre mean (SD)[1]	Int 2 pre mean (SD)[2]	Int 1 post mean (SD)[3]	Int 2 post mean (SD)[4]	MD [5]	Relative % change [6]	Adjusted relative % change[7]	SMD[8] (P value)[9]
(Eccles 2001)* Feedback on number of knee radiographs 6 months before and 6 months after the intervention plus guideline dissemination versus guideline dissemination	Number of knee radiographs per 1000 patients	7.03 (5.1)	6.67 (3.9)	6.32 (4.0)	7.02 (3.6)	0.7	10%	15%	0.2 (NR)
(Eccles 2001)* Reminder messages on radiograph reports plus guideline dissemination ver-	Number of knee radiographs per 1000 patients	7.18 (5.0)	6.67 (3.9)	5.22 (3.6)	7.02 (3.6)	1.8	26%	33%	0.5 **(P< 0.05)**

Table 21. Other musculoskeletal studies: Intervention versus a different intervention, continuous data (*Continued*)

sus guideline dissemination									
(Eccles 2001)* Feedback on number of knee radiographs 6 months before and 6 months after the intervention plus guideline dissemination plus reminder messages on radiograph reports versus guideline dissemination	Number of knee radiographs per 1000 patients	9.34 (6.1)	6.67 (3.9)	5.21 (3.7)	7.02 (3.6)	1.8	26%	64%	0.5 (NR)
(Eccles 2001)* Feedback on number of knee radiographs 6 months before and 6 months after the intervention plus guideline dissemination versus reminder messages on radiograph reports plus guideline	Number of knee radiographs per 1000 patients	7.03 (5.1)	7.18 (5.0)	6.32 (4.0)	5.22 (3.6)	-1.1	-21%	-24%	-0.3 (NR)

Table 21. Other musculoskeletal studies: Intervention versus a different intervention, continuous data (*Continued*)

dissemination									

1. Intervention 1 group pre-intervention mean (standard deviation)
2. Intervention 2 group pre-intervention mean (standard deviation)
3. Intervention 1 group post-intervention mean (standard deviation)
4. Intervention 2 group postintervention mean (standard deviation)
5. Mean Difference (MD)=Difference between post-intervention means. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
6. Relative percentage change post-intervention = (Int1 post mean - Int2 post mean)/Int2 post mean. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
7. Adjusted relative percentage change= (Int1 post mean-Int2 post mean)-(Int1 pre mean - Int2 pre mean)/Int2 post mean. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome.
8. SMD=Standardised Mean Difference=(Int1 post mean-Int2 post mean)/SD pooled. The direction of effect has been adjusted so that a positive result represents a beneficial intervention 1 outcome, according to Grimshaw 2004.
9. P value reported by study authors
*The above data reported above for Eccles 2001 was adjusted for clustering by the authors

Table 22. Summary of median absolute effect sizes (risk difference) of dichotomous outcomes for interventions aiming to increase or decrease a clinical behaviour

Table 23: Summary of median absolute effect sizes (risk difference) of dichotomous outcomes for interventions aiming to increase or decrease a clinical behaviour **Table 23: Summ mous outcomes haviour**

Study characteristic: behaviour targeted	Number of comparisons (n studies)	Median absolute effect size	Interquartile range	Range
Increase an existing clinical behaviour according to guidelines	68 (14)	5%	0.6% to 12.6%	-7.8% to 57.2%
Decrease an existing clinical behaviour according to guidelines	26 (7)	1.1%	-1.1% to 3%	-12.6% to 30.1%

Table 23. Summary of median effect sizes (risk difference) of dichotomous outcomes for interventions aiming to increase or decrease a clinical behaviour (including only comparisons from Low Back Pain studies)

Table 24: Summary of median effect sizes (risk difference) of dichotomous outcomes for interventions aiming to increase or decrease a clinical behaviour (including only comparisons from Low Back Pain studies) **Table 24: Summ outcomes for in (including only**

Study characteristic: behaviour targeted	Number of comparisons (n studies)	Median absolute effect size	Interquartile range	Range

Table 23. Summary of median effect sizes (risk difference) of dichotomous outcomes for interventions aiming to increase or decrease a clinical behaviour (including only comparisons from Low Back Pain studies) (*Continued*)

Increase an existing clinical behaviour according to guidelines	18 (2)	3.7%	-0.8% to 6.9%	-4.7% to 12.8%
Decrease an existing clinical behaviour according to guidelines	23 (6)	0.5%	-1.1% to 2.4%	-12.6% to 30.1%

Table 24. Summary of median effect sizes (risk difference) of dichotomous outcomes for interventions aiming to increase or decrease a clinical behaviour (including only comparisons from Osteoarthritis studies)

Table 25: Summary of median effect sizes (risk difference) of dichotomous outcomes for interventions aiming to increase or decrease a clinical behaviour (including only comparisons from Osteoarthritis studies)

Table 25: Summ outcomes for in (including only

Study characteristic: behaviour targeted	Number of comparisons (n studies)	Median absolute effect size	Interquartile range	Range
Increase an existing clinical behaviour according to guidelines	18 (3)	6.3%	-0.2% to 10%	-7.8% to 57.2%
Decrease an existing clinical behaviour according to guidelines	3 (1)	7.8%	6.1% to 13.4%	4.4% to 18.9%

APPENDICES

Appendix 1. Search strategies

MEDLINE OVID

Search date: October 24, 2013

1 exp musculoskeletal diseases/ or rheumatology/ or exp orthopedics/ or orthopedic procedures/ (857643)

2 (musculoskeletal or arthriti$ or orthop?edic? or osteo$ or polymyalg$ or periarthrit$).ti. (249636)

3 (arthritis or back pain or chondrocalcinosis or dermatomyositis or dupuytren? contracture or fibromyal$ or Fibrositis or Fibrositides or gout or hyperostos$ or low$ back or lupus or osteitis or osteoarthrit$ or osteoarthrop$ or osteochondr$ or Osteonecros$ or osteoporos$ or periarthriti$ or polymyalgia? or raynaud disease? or rheumatism or rheumatic disease? or sciatica or scleroderma$ or Spondylarthrit$).ti,ab. (352214)

4 (((cartiledge or connective tissue? or joint? or ligament? or muscula$ or myofascial or neck or soft tissue? or spine or spinal) adj2 (damage? or disease? or disorder? or injury or injuries or pain? or strain?)) and (care or treatment)).ti. (2884)
5 ((caplan? or felty's or Sjogren's or still's or wissler's) adj (disease? or syndrome?)).ti,ab. (11736)
6 ((elbow or hand? or knee or knees or leg or muscle or muscular$ or orthop?edic? or shoulder? or wrist?) adj2 (care or treatment? or injury or injuries or pain? or strain?)).ti,ab. (38503)
7 (athletic? adj2 (strain? or injury or injuries)).ti. (451)
8 Dermatomyositis/ or Dupuytren's Contracture/ or Lupus Erythematosus, Cutaneous/ or Lupus Erythematosus, Systemic/ or exp back pain/ or neck pain/ or sciatica/ or exp Raynaud Disease/ or exp Scleroderma, Systemic/ or exp arm injuries/ or athletic injuries/ or exp back injuries/ or exp dislocations/ or exp fractures bone/ or fractures cartilage/ or exp hand injuries/ or exp hip injuries/ or exp leg injuries/ or multiple trauma/ or exp neck injuries/ or soft tissue injuries/ or exp spinal cord injuries/ or exp spinal injuries/ or exp "sprains and strains"/ or exp tendon injuries/ or exp musculoskeletal system/ (1447111)
9 or/1-8 [MSK Rev] (2072899)
10 general practice/ or physicians, primary care/ [Terms added August 2012] (4535)
11 family practice/ or physicians, family/ or primary health care/ (122879)
12 ((family or general) adj2 (doctor? or medicine or medical practitioner? or medical practice? or practice? or practitioner? or physician$)).ti,ab. [Increased adj Aug 2012] (101849)
13 (primary adj2 (care or health care or healthcare or medical care or patient care)).ti,ab. (89077)
14 or/10-13 [Primary Care Rev ML] (217520)
15 (randomized controlled trial or controlled clinical trial).pt. or randomized.ab. or placebo.ab. or clinical trials as topic.sh. or randomly.ab. or trial.ti. (930250)
16 exp animals/ not humans.sh. (4051829)
17 15 not 16 [Cochrane RCT Filter 6.4.d Sens/Precision Maximizing] (859939)
18 intervention?.ti. or (intervention? adj6 (clinician? or collaborat$ or community or complex or DESIGN$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv$ or individuali?e? or individuali?ing or interdisciplin$ or multicomponent or multi-component or multidisciplin$ or multi-disciplin$ or multifacet$ or multi-facet$ or multimodal$ or multi-modal$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or practitioner? or prescrib$ or prescription? or primary care or professional$ or provider? or regulatory or regulatory or tailor$ or target$ or team$ or usual care)).ab. (165998)
19 (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or postintervention? or "post intervention?").ti,ab. [added 2.4] (10262)
20 (hospital$ or patient?).hw. and (study or studies or care or health$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw. (720981)
21 demonstration project?.ti,ab. (1984)
22 (pre-post or "pre test$" or pretest$ or posttest$ or "post test$" or (pre adj5 post)).ti,ab. (65680)
23 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (610)
24 trial.ti. or ((study adj3 aim?) or "our study").ab. (632839)
25 (before adj10 (after or during)).ti,ab. (362830)
26 ("quasi-experiment$" or quasiexperiment$ or "quasi random$" or quasirandom$ or "quasi control$" or quasicontrol$ or ((quasi$ or experimental) adj3 (method$ or study or trial or design$))).ti,ab,hw. [ML] (104437)
27 ("time series" adj2 interrupt$).ti,ab,hw. [ML] (1184)
28 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month$ or hour? or day? or "more than")).ab. (9391)
29 pilot.ti. (39876)
30 Pilot projects/ [ML] (84019)
31 (clinical trial or controlled clinical trial or multicenter study).pt. [ML] (649874)
32 (multicentre or multicenter or multi-centre or multi-center).ti. (29829)
33 random$.ti,ab. or controlled.ti. (779263)
34 (control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. not (controlled clinical trial or randomized controlled trial).pt. [ML] (412256)
35 "comment on".cm. or review.ti,pt. or randomized controlled trial.pt. [ML] (2959592)
36 review.ti. [EM] (255522)
37 (rat or rats or cow or cows or chicken? or horse or horses or mice or mouse or bovine or animal?).ti. (1368734)
38 exp animals/ not humans.sh. [ML] (4051829)

39 (animal$ not human$).sh,hw. [EM] (3956028)
40 *experimental design/ or *pilot study/ or quasi experimental study/ [EM] (24261)
41 ("quasi-experiment$" or quasiexperiment$ or "quasi random$" or quasirandom$ or "quasi control$" or quasicontrol$ or ((quasi$ or experimental) adj3 (method$ or study or trial or design$))).ti,ab. [EM] (104437)
42 ("time series" adj2 interrupt$).ti,ab. [EM] (1184)
43 (or/18-29,32-34) or experimental design/ or between groups design/ or quantitative methods/ or quasi experimental methods/ [PsycInfo] (2839256)
44 exp animals/ or animal?.ti,id,hw. [PsycInfo] (17706941)
45 (or/18-34) not (or/35,37-38) [EPOC Methods Filter 2.4 Medline] (2151565)
46 (or/18-25,28-29,32-33,40-42) not (or/36,39) [EPOC Methods Filter 2.4 EMBASE] (2199704)
47 43 not (or/36-37,44) [EPOC Methods Filter 2.4 PsycInfo] (339055)
48 9 and 14 [MSK & PC] (11460)
49 9 and 14 and 17 [MSK & PC & RCT FILTER] (1584)
50 (9 and 14 and 45) not 49 [MSK & PC & EPOC FILTER 2.4] (2810)
51 (201208$ or 201209$ or 201210$ or 201211$ or 201212$ or 2013$).ed,ep,yr. (1796601)
52 49 and 51 [rct] (167)
53 remove duplicates from 52 [RCT to export Oct 24-2013] (129)
54 50 and 51 [EPOC] (292)
55 remove duplicates from 54 [EPOC to export Oct 2013]

EMBASE OVID

Embase Classic+Embase <1947 to 2013 October 23>

1 exp *musculoskeletal disease/ or rheumatology/ or *orthopedics/ or *orthopedic surgery/ (1190591)
2 (arthrit$ or back pain or fibromyalg$ or gout or low$ back or musculoskeletal or orthop?edic? or lupus or osteitis or osteoarthrit$ or osteoarthrop$ or osteochondr$ or Osteonecros$ or osteoporos$ or periarthriti$ or polymyalgia? or rheumatism or rheumatic disease? or sciatica or scleroderma$ or Spondylarthrit$).ti. (311875)
3 ((arthritis or back pain or chondrocalcinosis or dermatomyositis or dupuytren? contracture or fibromyal$ or Fibrositis or Fibrositides or gout or hyperostos$ or low$ back or lupus or osteitis or osteoarthrit$ or osteoarthrop$ or osteochondr$ or Osteonecros$ or osteoporos$ or periarthriti$ or polymyalgia? or raynaud disease? or rheumatism or rheumatic disease? or sciatica or scleroderma$ or Spondylarthrit$) adj3 (care or treatment?)).ab. (24640)
4 (((cartiledge or connective tissue? or joint? or ligament? or muscula$ or myofascial or neck or soft tissue? or spine or spinal) adj2 (damage? or disease? or disorder? or injury or injuries or pain? or strain?)) and (care or treatment)).ti. (3734)
5 ((caplan? or felty's or Sjogren's or still's or wissler's) adj (disease? or syndrome?)).ti,ab. (15557)
6 ((elbow or hand? or knee or knees or leg or muscle or muscular$ or orthop?edic? or shoulder? or sprain$ or wrist?) adj4 (care or treatment)).ti,ab. (32341)
7 (athletic? adj2 (strain? or injury or injuries)).ti. (491)
8 (bone adj2 (fracture? or fractured)).ti. (2759)
9 ((bone? or cartiledge or connective tissue? or joint? or ligament? or muscula$ or myofascial or neck or soft tissue? or spine or spinal) adj2 (damage? or disease? or disorder? or injury or injuries or pain? or strain?)).ti. (49287)
10 *dermatomyositis/ or *Dupuytren contracture/ or *skin lupus erythematosus/ or *systemic lupus erythematosus/ or exp *backache/ or exp *leg pain/ or exp *musculoskeletal pain/ or *neck pain/ or *ischialgia/ or *Raynaud phenomenon/ or *scleroderma/ or exp *ARM INJURY/ or exp *TENDON INJURY/ or exp *SOFT TISSUE INJURY/ or exp *NECK INJURY/ or exp *HAND INJURY/ or exp *LEG INJURY/ or exp *SPINE INJURY/ or exp *SPINAL CORD INJURY/ or exp *HIP INJURY/ or *sport injury/ or *dislocation/ or exp *fracture/ or exp *sprain/ or muscle strain/ or exp *tendon injury/ (367353)
11 or/1-10 [MSK conditions] (1404842)
12 *general practitioner/ (15844)
13 *general practice/ (39859)
14 exp *primary health care/ (40728)
15 ((family or general) adj2 (doctor? or medical practitioner? or medical practice? or practice? or practitioner? or physician$)).ti,ab. (117580)
16 (primary adj2 (care or health care or healthcare or medical care or patient care)).ti,ab. (104088)

17 or/12-16 [Primary care] (231098)
18 controlled clinical trial/ or controlled study/ or randomized controlled trial/ [EM] (4244044)
19 (book or conference paper or editorial or letter or review).pt. not randomized controlled trial/ [Per BMJ Clinical Evidence filter] (4034696)
20 (random sampl$ or random digit$ or random effect$ or random survey or random regression).ti,ab. not randomized controlled trial/ [Per BMJ Clinical Evidence filter] (54247)
21 (animal$ not human$).sh,hw. (3913735)
22 18 not (or/19-21) [Trial filter per BMJ CLinical Evidence] (2801374)
23 intervention?.ti. or (intervention? adj6 (clinician? or collaborat$ or community or complex or DESIGN$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv$ or individuali?e? or individuali?ing or interdisciplin$ or multicomponent or multi-component or multidisciplin$ or multi-disciplin$ or multifacet$ or multi-facet$ or multimodal$ or multi-modal$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or practitioner? or prescrib$ or prescription? or primary care or professional$ or provider? or regulatory or regulatory or tailor$ or target$ or team$ or usual care)).ab. (201463)
24 (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or postintervention? or "post intervention?").ti,ab. [added 2.4] (12626)
25 (hospital$ or patient?).hw. and (study or studies or care or health$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw. (1623934)
26 demonstration project?.ti,ab. (2357)
27 (pre-post or "pre test$" or pretest$ or posttest$ or "post test$" or (pre adj5 post)).ti,ab. (93420)
28 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (809)
29 trial.ti. or ((study adj3 aim?) or "our study").ab. (838686)
30 (before adj10 (after or during)).ti,ab. (474031)
31 deleted line; no impact on strategy
32 deleted line; no impact on strategy
33 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month$ or hour? or day? or "more than")).ab. (11728)
34 pilot.ti. (49794)
35 deleted line; no impact on strategy
36 deleted line; no impact on strategy
37 (multicentre or multicenter or multi-centre or multi-center).ti. (39211)
38 random$.ti,ab. or controlled.ti. (932656)
39 (control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. not (controlled clinical trial or randomized controlled trial).pt. [ML] (615626)
40 deleted line; no impact on strategy
41 review.ti. [EM] (312835)
42 (rat or rats or cow or cows or chicken? or horse or horses or mice or mouse or bovine or animal?).ti. (1654258)
43deleted line; no impact on strategy
44 (animal$ not human$).sh,hw. [EM] (3913735)
45 *experimental design/ or *pilot study/ or quasi experimental study/ [EM] (6990)
46 ("quasi-experiment$" or quasiexperiment$ or "quasi random$" or quasirandom$ or "quasi control$" or quasicontrol$ or ((quasi$ or experimental) adj3 (method$ or study or trial or design$))).ti,ab. [EM] (128680)
47 ("time series" adj2 interrupt$).ti,ab. [EM] (1124)
48-50 deleted lines; no impact on strategy
51 (or/23-30,33-34,37-38,45-47) not (or/41,44) [EPOC Methods Filter 2.4 EMBASE] (3323291)
52 48 not (or/41-42,49) [EPOC Methods Filter 2.4 PsycInfo] (715574)
53 11 and 17 [MSK & Primary Care] (10572)
54 11 and 17 and 22 [MSK & PC & RCT] (2143)
55 (11 and 17 and 51) not 54 [MSK & PC & EPOC Filter] (3595)

Cochrane Library via OVID EBM Collection

Search date: October 2013

EBM Reviews - Cochrane Database of Systematic Reviews <2005 to September 2013>, EBM Reviews - ACP Journal Club <1991 to October 2013>, EBM Reviews - Database of Abstracts of Reviews of Effects <3rd Quarter 2013>, EBM Reviews - Cochrane Central Register of Controlled Trials <September 2013>, EBM Reviews - Cochrane Methodology Register <3rd Quarter 2012>, EBM Reviews - Health Technology Assessment <3rd Quarter 2013>, EBM Reviews - NHS Economic Evaluation Database <3rd Quarter 2013>

1 exp musculoskeletal diseases/ or rheumatology/ or exp orthopedics/ or orthopedic procedures/ (20864)
2 (musculoskeletal or arthrit$ or orthop?edic? or osteo$ or polymyalg$ or periarthrit$).ti. (13266)
3 (arthritis or back pain or chondrocalcinosis or dermatomyositis or dupuytren? contracture or fibromyal$ or Fibrositis or Fibrositides or gout or hyperostos$ or low$ back or lupus or osteitis or osteoarthrit$ or osteoarthrop$ or osteochondr$ or Osteonecros$ or osteoporos$ or periarthriti$ or polymyalgia? or raynaud disease? or rheumatism or rheumatic disease? or sciatica or scleroderma$ or Spondylarthrit$).ti,ab. (19487)
4 (((cartiledge or connective tissue? or joint? or ligament? or muscula$ or myofascial or neck or soft tissue? or spine or spinal) adj2 (damage? or disease? or disorder? or injury or injuries or pain? or strain?)) and (care or treatment)).ti. (472)
5 ((caplan? or felty's or Sjogren's or still's or wissler's) adj (disease? or syndrome?)).ti,ab. (247)
6 ((elbow or hand? or knee or knees or leg or muscle or muscular$ or orthop?edic? or shoulder? or wrist?) adj2 (care or treatment? or injury or injuries or pain? or strain?)).ti,ab. (5343)
7 (athletic? adj2 (strain? or injury or injuries)).ti. (14)
8 Dermatomyositis/ or Dupuytren's Contracture/ or Lupus Erythematosus, Cutaneous/ or Lupus Erythematosus, Systemic/ or exp back pain/ or neck pain/ or sciatica/ or exp Raynaud Disease/ or exp Scleroderma, Systemic/ or exp arm injuries/ or athletic injuries/ or exp back injuries/ or exp dislocations/ or exp fractures bone/ or fractures cartilage/ or exp hand injuries/ or exp hip injuries/ or exp leg injuries/ or multiple trauma/ or exp neck injuries/ or soft tissue injuries/ or exp spinal cord injuries/ or exp spinal injuries/ or exp "sprains and strains"/ or exp tendon injuries/ or exp musculoskeletal system/ (28264)
9 or/1-8 [MSK Rev] (53389
10 general practice/ or physicians, primary care/ [Terms added August 2012] (145)
11 family practice/ or physicians, family/ or primary health care/ (4521)
12 ((family or general) adj2 (doctor? or medicine or medical practitioner? or medical practice? or practice? or practitioner? or physician$)).ti,ab. [Increased adj Aug 2012] (6968)
13 (primary adj2 (care or health care or healthcare or medical care or patient care)).ti,ab. (7493)
14 or/10-13 [Primary Care Rev ML] (13418)
15 9 and 14 (1090)
16 limit 15 to yr="2012 - 2014" [Limit not valid in DARE; records were retained] (68)
17 from 16 keep 1-3 [CDSR] (3)
18 from 16 keep 4-7 [ACP] (4)
19 from 16 keep 8-9 [DARE] (2)
20 from 16 keep 10-53 [Central] (44)
21 from 16 keep 45-53 [HTA] (9)
22 from 16 keep 63-68 [EED] (6)

Cochrane Library, Issue 2, 2010 [Wiley]

Search Date: 2010-08-23 15:34:51.33

#1MeSH descriptor Musculoskeletal Diseases explode all trees
#2MeSH descriptor Rheumatology, this term only
#3MeSH descriptor Orthopedics explode all trees
#4MeSH descriptor Orthopedic Procedures, this term only
#5(musculoskeletal or arthritis or osteoarthritis):ab
#6(arthrit*):ti
#7((bone near/2 fracture*) or (bone near/2 fractured)):ti
#8(Chondrocalcinosis or dermatomyositis or dupuytren* contracture or fibromyalgia* or Fibrositis or Fibrositides or gout or hyperostos* or lupus or Musculoskeletal or orthopedic* or orthopaedic* or osteitis or osteoarthrit* or osteoarthrop* or osteochondr* or Osteonecros* or osteoporos* or periarthriti* or polymyalgia* or raynaud disease* or rheumati* or sciatica or scleroderma* or Spondylarthrit* or sprain*):ti

#9((caplan* or felty's or Sjogren's or still's or wissler's) near/ disease*):ti
#10((caplan* or felty's or Sjogren's or still's or wissler's) near/ syndrome*):ti
#11((bone* or cartiledge or connective tissue* or joint* or ligament* or muscula* or myofascial or neck or soft tissue* or spine or spinal) near/2 strain*):ti
#12((bone* or cartiledge or connective tissue* or joint* or ligament* or muscula* or myofascial or neck or soft tissue* or spine or spinal) near/2 damage*):ti
#13((bone* or cartiledge or connective tissue* or joint* or ligament* or muscula* or myofascial or neck or soft tissue* or spine or spinal) near/2 disease*):ti
#14((bone* or cartiledge or connective tissue* or joint* or ligament* or muscula* or myofascial or neck or soft tissue* or spine or spinal) near/2 disorder*):ti
#15((bone* or cartiledge or connective tissue* or joint* or ligament* or muscula* or myofascial or neck or soft tissue* or spine or spinal) near/2 injury):ti
#16((bone* or cartiledge or connective tissue* or joint* or ligament* or muscula* or myofascial or neck or soft tissue* or spine or spinal) near/2 pain*):ti
#17((bone* or cartiledge or connective tissue* or joint* or ligament* or muscula* or myofascial or neck or soft tissue* or spine or spinal) near/2 injuries):ti
#18((elbow) near/2 (injury or injuries or pain* or strain*)):ti
#19((shoulder) near/2 (injury or injuries or pain* or strain*)):ti
#20((hand*) near/2 (injury or injuries or pain* or strain*)):ti
#21(knee near/2 (injury or injuries or pain* or strain*)):ti
#22(athletic* near/2 (strain* or injury or injuries)):ti
#23MeSH descriptor Dermatomyositis, this term only
#24MeSH descriptor Dupuytren Contracture, this term only
#25MeSH descriptor Lupus Erythematosus, Cutaneous, this term only
#26MeSH descriptor Lupus Erythematosus, Systemic explode all trees
#27MeSH descriptor Back Pain explode all trees
#28MeSH descriptor Sciatica, this term only
#29MeSH descriptor Raynaud Disease, this term only
#30MeSH descriptor Scleroderma, Systemic explode all trees
#31MeSH descriptor Arm Injuries explode all trees
#32MeSH descriptor Neck Pain explode all trees
#33MeSH descriptor Athletic Injuries, this term only
#34MeSH descriptor Back Injuries explode all trees
#35MeSH descriptor Dislocations explode all trees
#36MeSH descriptor Fractures, Bone explode all trees
#37MeSH descriptor Fractures, Cartilage, this term only
#38MeSH descriptor Hand Injuries explode all trees
#39MeSH descriptor Hip Injuries explode all trees
#40MeSH descriptor Leg Injuries explode all trees
#41MeSH descriptor Multiple Trauma, this term only
#42MeSH descriptor Neck Injuries explode all trees
#43MeSH descriptor Soft Tissue Injuries, this term only
#44MeSH descriptor Spinal Cord Injuries explode all trees
#45MeSH descriptor Sprains and Strains explode all trees
#46MeSH descriptor Tendon Injuries explode all trees
#47MeSH descriptor Musculoskeletal System explode all trees
#48(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47)
#49MeSH descriptor Family Practice, this term only
#50MeSH descriptor Physicians, Family, this term only
#51MeSH descriptor Primary Health Care, this term only

#52(general near/ (doctor* or medicine or medical practitioner* or medical practice* or practice* or practitioner* or physician*)):ti,ab
#53(family near/ (doctor* or medicine or medical practitioner* or medical practice* or practice* or practitioner* or physician*)):ti,ab
#54(primary near/2 (care or health care or healthcare or medical care or patient care)):ti,ab
#55(#49 OR #50 OR #51 OR #52 OR #53 OR #54)
#56intervention*:ti
#57(intervention* near/6 (clinician* or collaborat* or community or complex or doctor* or educational or family doctor* or family physician* or family practitioner* or financial or GP or general practice* or hospital* or impact* or improv* or individuali*e* or individuali*ing or interdisciplin* or multicomponent or multi-component or
multidisciplin* or multi-disciplin* or multifacet* or multi-facet* or multimodal* or multi-modal* or personali*e* or personali*ing or pharmacies or pharmacist* or pharmacy or
physician* or practitioner* or prescrib* or prescription* or primary care or professional* or provider* or regulatory or regulatory or tailor* or target* or team* or usual care)):ab
#58((evidence near/4 intervention) or (evidence-based near/4 intervention) or (evidence-driven)):ti,ab
#59"practice-based":ti,ab
#60(improv* near/3 (decision* or implement* or health care or healthcare or initiative* or management or multifacet* or multi-facet* or multi-component or practi*e* or practitioner* or prescrib* or prescription* or professional* or program* or programme* or provider*)):ti
#61(improv* near/2 (patient-care or family practice or ((family or general) near/2 (practi*e or practitioner* or doctor*)) or primary care)):ab
#62recommended practice*:ti,ab
#63((information or evidence) near/2 uptake):ti,ab
#64(knowledge near/2 (application or broke* or creation or diffus* or disseminat* or exchang* or implement* or management or mobili* or translat* or transfer* or uptake or utili*)):ti,ab
#65(evidence* near/2 (exchang* or translat* or transfer*)):ti,ab
#66(KT near/2 (application or broke* or diffus* or disseminat* or decision* or exchang* or implement* or intervent* or mobili* or plan* or policy or policies or strateg* or translat* or transfer* or uptake or utili*)):ti,ab
#67((computer-tailored or individuali*ing or individuali*ed or personali*e* or personali*ing or tailor*) near/2 (feedback or intervention* or information or plan*)):ti,ab
#68((conventional or evidence-based or pattern or regular or routine or standard or traditional or usual) near/2 (care or healthcare or patient care or practice)):ti,ab #69(collaborative* or interdisciplin* or inter-disciplin* or multidisciplin* or multi- disciplin* or team* or team-based or skill- mix):ti
#70(skill* near/2 (mix or mixes)):ti,ab
#71((collaborative) near/2 (care or patient care or healthcare)):ab
#72((multidisciplinary) near/2 (care or patient care or healthcare)):ab
#73((interdisciplinary) near/2 (care or patient care or healthcare)):ab
#74(doctor-driven or doctor-led or GP-LED or nurse-led or nurse-driven or pharmacist-led or pharmacist-driven or physician-led or physician- driven):ti,ab
#75physician directed:ti,ab
#76(leaflet* or pamphlet* or "written information"):ti
#77((leaflet*) near/5 (intervention* or care or healthcare or physician* or practitioner* or provider*)):ab
#78((pamphlet*) near/5 (intervention* or care or healthcare or physician* or practitioner* or provider*)):ab
#79(("written information") near/5 (intervention* or care or healthcare or physician* or practitioner* or provider*)):ab
#80((academic detailing or e-detailing) or (opinion* near/2 leader*)):ti,ab
#81("audit and feedback"):ti,ab
#82((physician* or doctor* or practitioner* or nurse* or provider*) near/ feedback):ti,ab
#83(clinician* near/2 (prompt or prompts or prompting)):ti,ab or (physician* near/2 (prompt or prompts or prompting)):ti,ab or (remind* near/2 (prompt or prompts or prompting)):ti,ab
#84(reminder* near/2 (clinician* or physician* or practitioner* or nurse* or doctor* or provider*)):ti,ab
#85MeSH descriptor Reminder Systems, this term only
#86((doctor* or nurse* or pharmacist* or physician* or practitioner*) near/2 behavio*r*):ti,ab
#87(nurse* near/4 substitut*):ti,ab
#88(practice pattern*):ti,ab or ((change* or changing) near/2 practice):ti,ab
#89MeSH descriptor Physician's Practice Patterns, this term only

#90(nurse-practitioner* or physician* assistant*):ti
#91((doctor* or pharmacist* or physician*) near/2 role*):ab
#92MeSH descriptor Referral and Consultation, this term only
#93(Referral* and (primary care or specialist* or general practitioner* or change* or changing or improv* or impact or effect* or reduce* or reducing or increase* or increasing or optimi* or optimal or quality or healthcare or patient care or intensive care or emergency or chronic or management or administration)):ti,ab
#94(Referral* and (primary care or specialist* or general practitioner* or optimi*e* or optimal)):ti or (Referral* near/3 (primary care or specialist* or general practitioner* or optimi*e* or optimal)):ab
#95((nurse* or physician* or pharmacist* or provider*) near/2 initiative*):ti,ab
#96(virtual reality or VR Training or VR simulat* or (simulat* near/2 skill*)):ti,ab
#97(blog* or wiki* or PDA or "palm pilot* " or blackberr* or Twitter or tweet or tweeting or facebook or social networking or social marketing or youtube):ti,ab or blogging or (health 20 or healthcare 20 or health care 20 or web 20):ti,ab
#98(guideline adherence or (guideline* near/3 (adherence or compliance or concordance or implement* or UPTAKE))):ti,ab
#99((individuali* near/2 (care or healthcare or medical care)) or (integrated near/2 (care or healthcare or medical care)) or (patient-centred or patient-centered or patient-control*)):ti,ab
#100quality improvement:ti,ab
#101(Patient satisfaction or algorithm*):ti,ab
#102MeSH descriptor Education, Pharmacy, Continuing, this term only
#103MeSH descriptor Education, Medical, Continuing, this term only
#104MeSH descriptor Education, Nursing, Continuing, this term only
#105MeSH descriptor Education, Professional, this term only
#106(continuing near/2 education near/3 (physician* or nurse* or nursing or practitioner* or doctor* or family physician* or general practitioner* or family doctor* or primary care or primary healthcare)):ab
#107(continuing near/3 education):ti
#108((continuing or "on the job" or "off the job" or postgrad* or post-grad* or resident* or intern* or internship* or workplace) near/2 training):ti,ab
#109(((continuing or "on the job" or "off the job" or postgrad* or post-grad* or resident* or intern* or internship* or workplace) near/2 education*) or (skill* near/ (education or training))):ti,ab
#110(#56 OR #57 OR #58 OR #59 OR #60 OR #61 OR #62 OR #63 OR #64 OR #65 OR #66 OR #67 OR #68 OR #69 OR #70 OR #71 OR #72 OR #73 OR #74 OR #75 OR #76 OR #77 OR #78 OR #79 OR #80 OR #81 OR #82 OR #83 OR #84 OR #85 OR #86 OR #87 OR #88 OR #89 OR #90 OR #91 OR #92 OR #93 OR #94 OR #95 OR #96 OR #97 OR #98 OR #99 OR #100 OR #101 OR #102 OR #103 OR #104 OR #105 OR #106 OR #107 OR #108 OR #109)
#111(#48 AND #55)
#112(#48 AND #55 AND #110)
#113(#111 OR #112)

CINAHL, EbscoHost 1980-

Search dates: August 24, 2010 AND november 20, 2013

	Date: 20100101-20131231 **NOVEMBER 20, 2013**	288
S52	S51 or S50 [All Results] **AUGUST 24, 2010**	608
S51	S49 and S46 (Results with EPOC 1.7 Filter)	485
S50	S49 and S45 (Results with RCT filter)	302

(*Continued*)

S49	S47 and S48 and S17 (S17= primary Care terms)	1681
S48	S18 or S19 or S20 or S21 or S22 or S23 (Education/Collaboration Intervention terms)	76261
S47	S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9 or S10 or S11 or S12 or S13 or S14 or S15 or S16 (MSK terms)	404871
S46	S24 or S25 or S26 or S27 or S28 or S29 or S30 or S31 or S32 or S34 or S35 or S36 or S37 or S38 (EPOC Filter 1.7)	187032
S45	S39 or S40 or S41 or S42 or S43 or S44 (RCT filter)	126098
S44	TI ("control* N1 clinical" or "control* N1 group*" or "control* N1 trial*" or "control* N1 study" or "control* N1 studies" or "control* N1 design*" or "control* N1 method*") or AB ("control* N1 clinical" or "control* N1 group*" or "control* N1 trial*" or "control* N1 study" or "control* N1 studies" or "control* N1 design*" or "control* N1 method*")	57555
S43	TI controlled or AB controlled	44233
S42	TI random* or AB random*	77414
S41	TI ("clinical study" or "clinical studies") or AB ("clinical study" or "clinical studies")	11229
S40	(MM "Clinical Trials+")	6045
S39	TI ((multicent* n2 design*) or (multicent* n2 study) or (multicent* n2 studies) or (multicent* n2 trial*)) or AB ((multicent* n2 design*) or (multicent* n2 study) or (multicent* n2 studies) or (multicent* n2 trial*))	5282
S38	TI pilot	7878
S37	(MH "Pilot Studies")	20827
S36	AB "before-and-after"	12207
S35	AB time series	1089
S34	TI time series	141
S33	AB (before* n7 during or before n3 after) or AU (before* n7 during or before n3 after)	19048

(*Continued*)

S32	TI ((time point*) or (period* n4 interrupted) or (period* n4 multiple) or (period* n4 time) or (period* n4 various) or (period* n4 varying) or (period* n4 week*) or (period* n4 month*) or (period* n4 year*)) or AB ((time point*) or (period* n4 interrupted) or (period* n4 multiple) or (period* n4 time) or (period* n4 various) or (period* n4 varying) or (period* n4 week*) or (period* n4 month*) or (period* n4 year*))	34841
S31	TI ((quasi-experiment* or quasiexperiment* or quasi-random* or quasirandom* or quasi control* or quasicontrol* or "quasi* W3 method*" or "quasi* W3 study" or "quasi* W3 studies" or "quasi* W3 trial" or "quasi* W3 design*" or "experimental W3 method*" or "experimental W3 study" or "experimental W3 studies" or "experimental W3 trial" or "experimental W3 design*")) or AB ((quasi-experiment* or quasi-experiment* or quasi-random* or quasirandom* or quasi control* or quasicontrol* or "quasi* W3 method*" or "quasi* W3 study" or "quasi* W3 studies" or "quasi* W3 trial" or "quasi* W3 design*" or "experimental W3 method*" or "experimental W3 study" or "experimental W3 studies" or "experimental W3 trial" or "experimental W3 design*"))	8591
S30	TI pre w7 post or AB pre w7 post	6142
S29	MH "Multiple Time Series" or MH "Time Series"	922
S28	TI ((comparative N2 study) or (comparative N2 studies) or "evaluation study" or "evaluation studies") or AB ((comparative N2 study) or (comparative N2 studies) or "evaluation study" or "evaluation studies")	5677
S27	MH Experimental Studies or Community Trials or Community Trials or Pretest-Posttest Design + or Quasi-Experimental Studies + Pilot Studies or Policy Studies + Multicenter Studies	24708
S26	TI ("pre test*" or pretest* or posttest* or "post test*") or AB ("pre test*" or pretest* or posttest* or "post test*")	5942
S25	TI (intervention* or multiintervention* or multi-intervention* or postintervention* or post-intervention* or preintervention* or pre-intervention*) or AB (intervention* or multiintervention* or multi-intervention* or postintervention* or post-intervention* or preintervention* or pre-intervention*)	105013
S24	(MH "Quasi-Experimental Studies")	4258
S23	(MH "Professional Development")	10105

(*Continued*)

S22	(MH "Practice Patterns") OR (MH "Prescribing Patterns")	3110
S21	AB ((multifacet* or multi-facet* or multimodal* or multi-modal* or multidisciplin* or interdisciplin* or collaborat* or shared or team-based or team or skill-mix or inter-disciplin* or multi-disciplin*)) and AB ((care or practice or decsion* or refer* or consult*))	32079
S20	(MH "Education, Medical, Continuing") OR (MH "Education, Nursing, Continuing")	10047
S19	(MH "Multidisciplinary Care Team")	15543
S18	(MH "Referral and Consultation") OR (MH "Group Practice")	12699
S17	(MH "Family Practice") OR (MH "Physicians, Family") OR (MH "Primary Health Care") OR AB ("primary care" or "family physician*" or "family doctor*" or "primary health")	41203
S16	TI (caplan* or felty's or Sjogren's or still's or wissler's) N disease*	266964
S15	TI (Chondrocalcinosis or dermatomyositis or dupuytren* contracture or fibromyalgia* or Fibrositis or Fibrositides or gout or hyperostos* or lupus or Musculoskeletal or orthopedic* or orthopaedic* or osteitis or osteoarthrit* or osteoarthrop* or osteochondr* or Osteonecros* or osteoporos* or periarthriti* or polymyalgia* or raynaud disease* or rheumati* or sciatica or scleroderma* or Spondylarthrit* or sprain*)	19656
S14	(MH "Dermatomyositis") OR (MH "Musculoskeletal System+")	64039
S13	(MH "Back Pain+") OR (MH "Neck Pain")	13141
S12	(MH "Sciatica")	443
S11	(MH "Tendon Injuries+") OR (MH "Soft Tissue Injuries") OR (MH "Spinal Cord Injuries+") OR (MH "Dislocations+")	14157
S10	(MH "Multiple Trauma")	1104
S9	(MH "Dupuytren's Contracture") OR (MH "Scleroderma, Systemic+")	1057
S8	(MH "Raynaud's Disease")	299

(*Continued*)

S7	(MH "Back Injuries+") OR (MH "Arm Injuries+") OR (MH "Athletic Injuries+") OR (MH "Fractures+") OR (MH "Hand Injuries+") OR (MH "Leg Injuries+") OR (MH "Neck Injuries+") OR (MH "Sprains and Strains+")	38128
S6	(MH "Arthritis+")	19407
S5	(MH "Orthopedic Care") OR (MH "Orthopedic Surgery")	5307
S4	(MH "Orthopedics")	4192
S3	(MH "Rheumatology")	676
S2	(MH "Lupus Erythematosus, Systemic+")	2417
S1	(MH "Musculoskeletal Diseases+")	72861

CONTRIBUTIONS OF AUTHORS

VTB, DM and MU conceived and designed the review. VTB and NM screened search results and DM and MU acted as arbitrators when disagreement arose. VTB and NM extracted data from included studies. VTB led the interpretation and write up of the results of the review, and DM, MU and OW provided detailed comments and guidance on different aspects of the review.

DECLARATIONS OF INTEREST

Victoria Tzortziou Brown: None to declare

Martin Underwood: None to declare

Noman Mohamed: None to declare

Olwyn Westwood: None to declare

Dylan Morrissey: None to declare

SOURCES OF SUPPORT

Internal sources

- Centre for Sports and Exercise Medicine, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, UK.

PhD supervision

- Institute of Health Science Education, Barts and The London School of Medicine and Dentistry at Queen Mary, University of London, UK.

PhD supervision

- Health Sciences Research Institute, Warwick Medical School, UK.

PhD supervision

External sources

- National Institute for Health Research (NIHR), UK.

Funding of the review protocol

- Arthritis Research UK, UK.

Funding of the work on the full review

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Michelle Fiander, Trials Search Co-ordinator (TSC) for the EPOC Group, reviewed the search strategy in 2008, and recommended changes in order to broaden the scope of the review and identify all relevant studies. These revised strategies were based on the 2008 strategy and finalised in consultation with the authors.

We revised the wording of the primary outcomes so that this is more consistent with the EPOC guidance on reporting outcomes in EPOC reviews (EPOC 2013d).

We modified some of the planned methods documented in the protocol in response to piloting and advances in the methods for systematic reviews. As noted in the main text of the review, we modified the search strategy, we changed the methods of assessment of risk of bias, and changed some of the methods of data analysis.

In the protocol we mentioned that "*We will pool the results of studies in this review if at least two studies are homogeneous regarding the participants, interventions and outcomes. Because of the expected diversity of the interventions and outcomes, it may not be possible to pool the results.*" We explored the possibility of grouping the studies by intervention type and pooling the results to assess their effect. However, this was not always clinically appropriate because not all intervention outcomes were applicable to all musculoskeletal conditions (for example, BMD testing was only applicable in osteoporosis). We concluded that clinically, the main source of heterogeneity amongst studies was the musculoskeletal condition studied, as this often determined the type of intervention and measured outcomes. Therefore, and in accordance with the protocol, we presented a narrative summary after grouping the studies by condition, and we included in a meta-analysis only those studies which were sufficiently similar in terms of intervention and outcomes.

We further divided the osteoporosis studies which were sufficiently similar to allow their results to be combined, into those where the intervention targeted just physicians versus those where both physicians and patients were targeted. This allowed an assessment of the effect of adding a patient-directed component to interventions targeting a physician in order to establish whether the combined intervention results in improved outcomes.

We used risk differences and risk ratios to express the effect sizes for dichotomous outcomes, in accordance with the protocol. For the expression of the meta-analysis results, we decided to use risk ratios because reporting relative effect measures is, on average, more consistent, in accordance with the *Cochrane Handbook* (Deeks 2011). However, we also conducted a sensitivity analysis in order to investigate whether the choice of the summary statistic was critical to the conclusions of the meta-analysis.

We planned to do a sensitivity analysis in order to re-examine our inclusion criteria with regards to the study design, as mentioned in the protocol. However, in view of the fact that all studies in the meta-analysis were RCTs, we could not undertake a sensitivity analysis after removing the NRCTs, as planned in the protocol where we mentioned that we would conduct further "*analyses based upon study design (RCT versus other)*".

We did a subgroup analysis to assess the intended direction of the intervention's effect on the targeted behavioural change (i.e. whether increasing or decreasing an existing behaviour resulted in different effects).

Two additional authors (Olwyn Westwood and Noman Mohamed) joined the review for this update.

The surname of the corresponding author is changed to "Tzortziou Brown".

INDEX TERMS

Medical Subject Headings (MeSH)

*Bone Density; Back Pain [diagnosis; therapy]; Bone Density Conservation Agents [therapeutic use]; Controlled Before-After Studies; General Practitioners [*education]; Guideline Adherence; Interrupted Time Series Analysis; Musculoskeletal Diseases [*diagnosis; *therapy]; Osteoarthritis [diagnosis; therapy]; Osteoporosis [diagnosis; therapy]; Randomized Controlled Trials as Topic; Reminder Systems; Shoulder Pain [diagnosis; therapy]

MeSH check words

Humans